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REPORT NO. R-245-025

ROUGH TERRAIN LANDING GEAR

M-245

313 000

XEROX

FAIRCHILD AIRCRAFT & MISSILES DIVISION

HAGERSTOWN 10, MARYLAND

TREC 80-39

**DESIGN, FABRICATION, AND TEST OF HIGH-FLOTATION TIRES AND
RELATED VALVING MECHANISM FOR ROUGH TERRAIN LANDING GEAR.**

**REPORT NUMBER R-245-025
PROJECT M-245
BY
FAIRCHILD AIRCRAFT & MISSILES DIVISION
HAGERSTOWN 10, MARYLAND**

**UNITED STATES ARMY
TRANSPORTATION RESEARCH COMMAND
Fort Eustis, Virginia**

Contract No. DA 44-177-TC-446 Project No. 9R38-01-017-47

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FAIRCHILD AIRCRAFT AND MISSILES DIVISION

H A G E R S T O W N 10, M A R Y L A N D

S U B J E C T DESIGN, FABRICATION, AND TEST OF HIGH-
FLOTATION TIRES AND RELATED VALVING
MECHANISM FOR ROUGH TERRAIN LANDING GEAR



PREPARED BY V. Frisby REPORT NO. R245-025
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1. INTRODUCTION

a. This report covers the results of experiments directed toward the design, development, and testing of a laboratory-model, rough-terrain landing gear system using foldable high-flotation tires built by a novel continuously-wound-cord method and using venting-hub shock absorption. The contemplated end use of such a system is for STOL aircraft operated from rough, unprepared fields. The tires, due to their relatively light weight, low inflation pressures, and economical methods of production, can also be ideally adapted to land vehicles for off-road use, offering improved cross-country trafficability with lessened tare weight. This prototype development project was preceded by analytical studies which indicated feasibility and which were reported upon by Fairchild Aircraft Division Reports Number R245-004I, R245-004II, and R245-004III, entitled, "Analytical Study of High Flotation Tires for Aircraft."

b. Early in this program, it was recognized that development of the capability of operating aircraft from rough unpaved fields would require revolutionary advances in tire design and manufacturing techniques in order to achieve low inflation pressures and to minimize weight penalties. In addition, the size of low pressure tires posed problems of stowage space; and the ability to envelop rigid obstacles, rather than rolling over them, demanded higher deflections in the tires than was available from tires built by conventional methods. This latter aspect led to exploration of pneumatic shock absorption methods in order to overcome the rebound inherent during landing from the undamped spring action of low-pressure tires with high deflection. There were three problem areas: weight, size, and rebound.

c. Details of the work in these problem areas are presented in the appendices to this report which are, in themselves, complete reports of the work in question. The main body of the report summarizes the findings and conclusions of the reports appended hereto. No extensive discussions are contained in this main body.

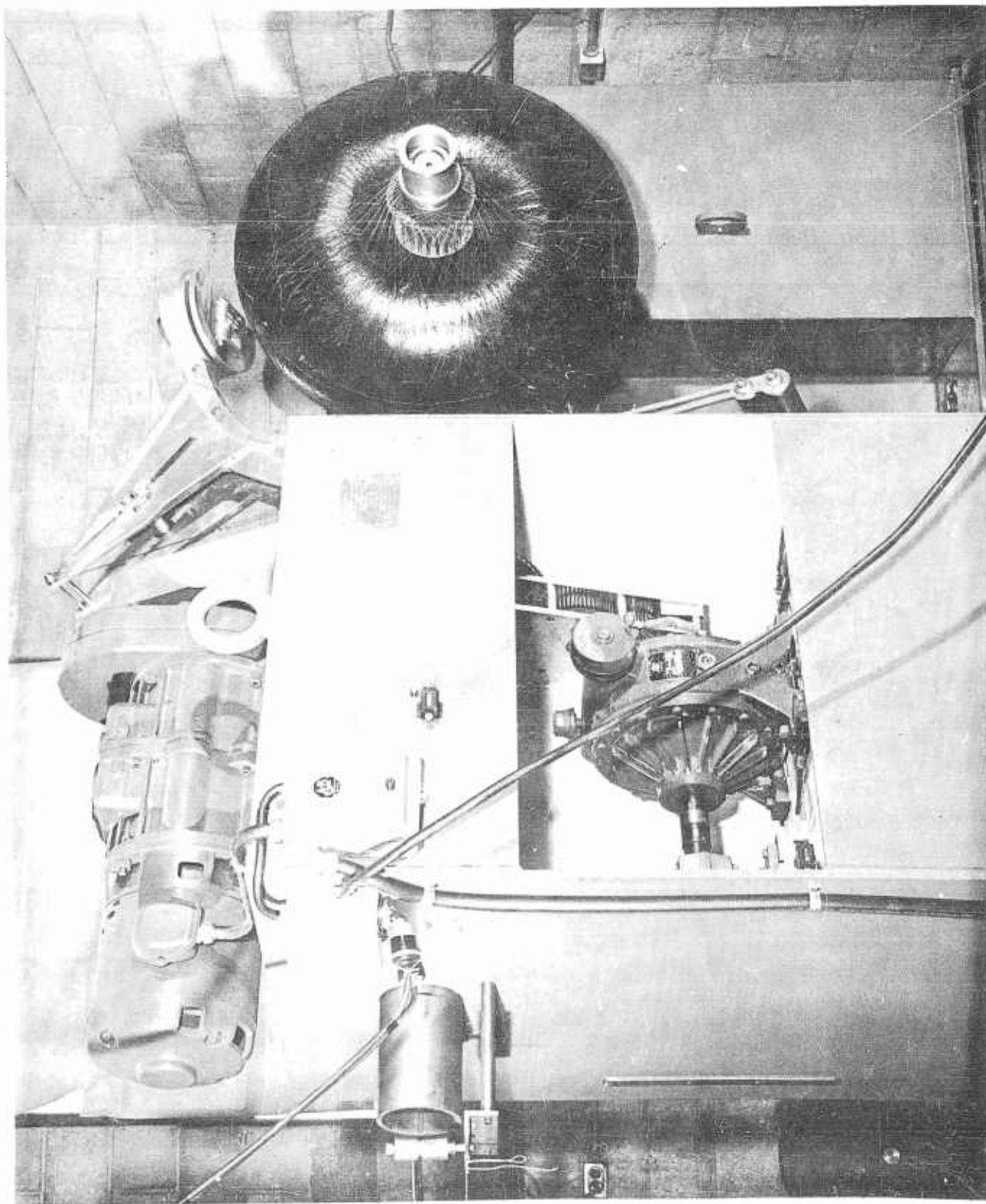
2. SUMMARIES

As would be concluded from a perusal of the appendices, workable solutions have been found for the problems cited in the above introduction. Feasibility of the novel, continuously-wound-cord, high-flotation, foldable tires has been demonstrated. Considerable research must still be conducted, however, before minimum weights and maximum service life are attained. Likewise, shock absorption and damping of the rebound of the high deflection, low pressure tires have been demonstrated. And, finally, folding of these tires in a slipstream at 95 knots was achieved. Summaries of the results of the work in each problem area - tire building, shock absorption, and folding - are presented in the following lettered sub-paragraphs:

a. Continuously-Wound-Cord Tires

(1) As reported in detail by Appendix 1, Development of Techniques for Building High-Flotation Tires of Continuously-Wound-Cord, R245-015, feasibility of production of foldable, high-flotation tires by the novel, continuously-wound-cord process has been demonstrated and a number of successful tires have been built by this method. The basic process can be deduced from examination of Figure 1, a photograph of the specially-built winding equipment. Briefly, tire cord, freshly coated with green, uncured carcass-stock rubber is passed through the hollow spindle of the winding arm, over fair leads on the arm and is wound into position on the mandrel on which has been applied a sheet of liner stock rubber. The winding arm rotates clockwise viewed from the left side of Figure 1 and the mandrel rotates counterclockwise viewed from the front of the figure. It may be noticed that the winding position of the hubs is outboard on the spindle of the mandrel at the distance from the mandrel which provides the desired tension in the cord when the hubs are pushed into the curing position in the recesses on each side of the mandrel. Varying the rotational velocities of the winding arm and mandrel varies the cord pattern across the tread areas of the tire. By varying these velocities, the shape of the mandrel, the size of the hubs, and the clearance between the end of the winding arm and the mandrel,

Figure 1



2. SUMMARIES (Continued)

a. Continuously-Wound-Cord Tires (Continued)

any reasonable cord pattern can be achieved in the tire. Since the cord pattern determines the inflated shape, and this in turn affects stress distribution in the tire when in service, this basic method permits remarkably close control of tire characteristics. In other words, the method gives precise control of the density and direction of the tire cord, throughout the carcass, in the cured tire.

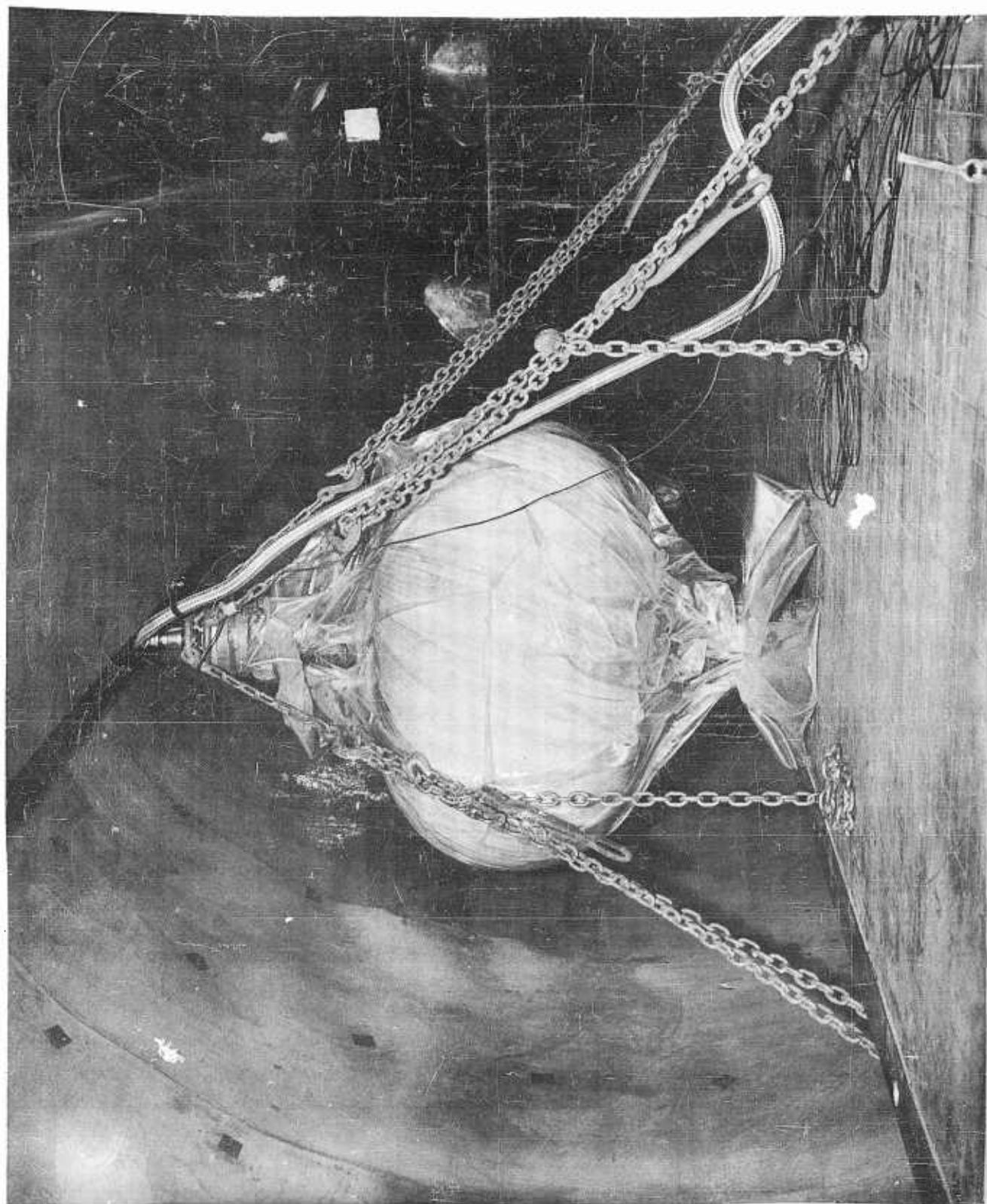
(2) After the required amount of cord is wound into place on the mandrel, another thin sheet of carcass stock rubber is applied over the cord, the desired tread stock is applied over the tread area of the tire, the mandrel is removed from its spindle, the hubs jacked toward each other into the curing position, special curing flanges are placed concentric to each hub, the whole assembly is covered with a pressure barrier of plastic film, and the assembly placed in an autoclave for cure. During the curing process, a vacuum is maintained on the inside of the tire to assure that curing tank pressure is maintained on the carcass. This positive pressure coupled with the vacuum assures that air trapped in the carcass during winding is removed from the tire during the cure and that any volatile material in the uncured rubber is likewise removed. Figure 2 shows a 34-inch tire in the curing autoclave.

(3) Additional conclusions from Appendix 1 are as follows:

(a) The techniques presently available for the continuous-cord tire-building need to be refined and the process simplified before production of continuously-wound tires is programmed.

(b) Analysis of the presently available techniques points clearly towards the path to follow during the evolution of satisfactory manufacturing processes.

Figure 2



2. SUMMARIES (Continued)

a. Continuously-Wound-Cord Tires (Continued)

(3) (c) Uncertainty in the stress distribution in a high-flotation tire carcass when severely deformed under load indicates that it will be necessary to use empirical methods in the refinement of the design of continuously-wound-cord tires.

b. Characteristics of High-Flotation, Foldable Tires

(1) When the tire building experiments had progressed sufficiently so that several successful laboratory-model tires had been produced and future success could be logically predicted, it was decided to flight test the system. Preliminary to design of the flight-test, venting hub system, the test model tires were submitted to exhaustive tests to determine their load carrying ability and their reaction to encountering rigid obstacles and crossing pot-holes. Static tests on a specially design test rig produced the load deflection curves of Figure 3. The test rig is shown by Figure 4. These curves and other data obtained from the static tests are contained in Appendix 2. These other data include side and drag loads developed on the tire just prior to skidding for various vertical loads at several inflation pressures.

(2) The static tests were followed by dynamic tests to determine rolling resistance, cornering forces developed when the tire was steered and the reactions to encountering rigid obstacles and crossing ditches, all at several vertical loads and inflation pressures and at several speeds. These rolling tests were made with the same rig (Figure 4) operated as a semi-trailer. The dynamometer column on this rig was instrumented to secure simultaneous readings of the three perpendicular forces along the primary axes and the three moments about these axes. Typical results of these tests are presented by Figures 5 through 9. Details of the dynamic, or rolling test program, are contained in Appendix 3.

Figure 3

NE 10 X 10 TO THE 1/2 INCH 359-11
KEUFFEL & ESSER CO. MADE IN U.S.A.

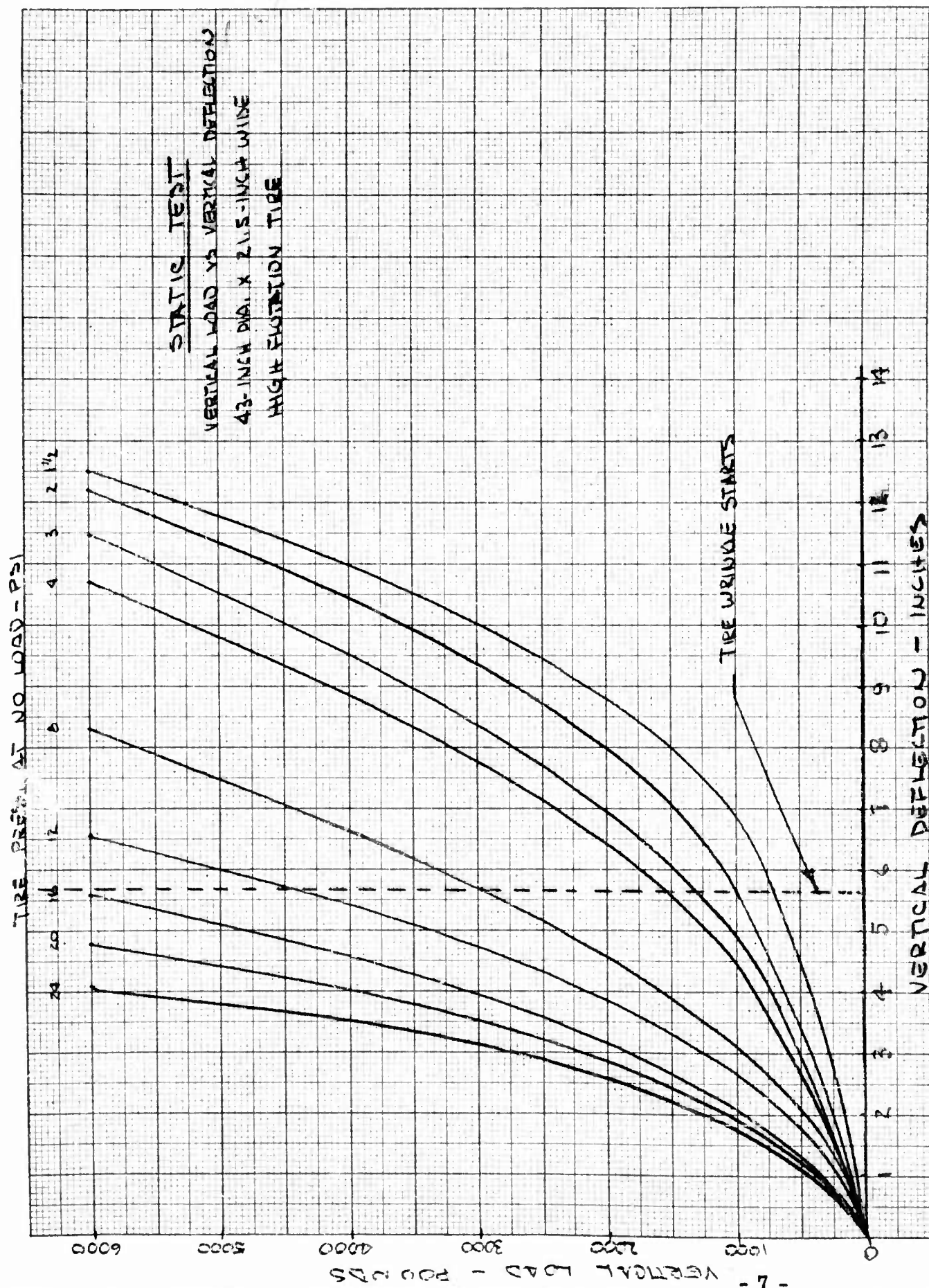


Figure 4

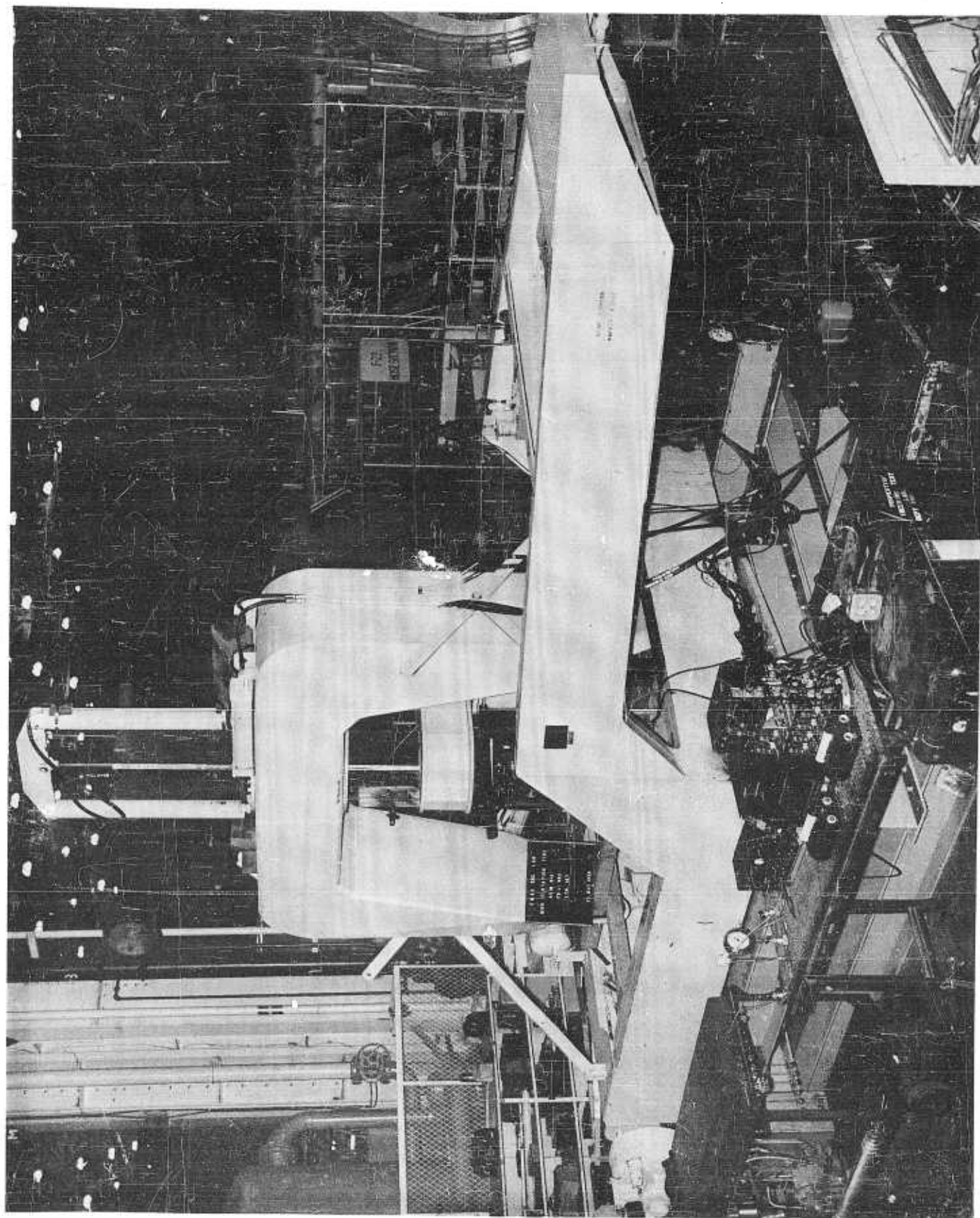


Figure 5

High Flotation Tire - Obstacle Test								
Record No.	Obstacle Height	Tire Pressure (P.S.I.)	Static Vert. Load (Lbs.)	*Actual Vertical Load (Lbs.)	Peak Loads Occuring at Obstacles			
					Vert. Load (Lbs.)	Drag Load (Lbs.)	Side Moment In. (Lbs.)	Wheel Speed (m. p. h.)
12192	2"	4	1500	2400	3800	336 -895	-5285	28.6
12195	2"	4	1500	2800	4660	496 -870	-5285	40.1
12246	2"	4	3000	5470	8542	315 -1347	-2610	30.5
12247	2"	4	3000	5470	8817	516 -1081	-2610	19.5
12203	2"	8	1500	2870	5897	280 -1036	-5285	40.1
12204	2"	12	1500	2200	5292	336 -730	-7926	19.6
12206	2"	12	1500	3070	5065	392 -440	-10570	43.0
12218	2"	12	3000	5200	8392	590 -810	-2610	19.1
12219	2"	12	3000	5670	9148	560 -560	-2610	39.1
12207	2"	12	1500	2270	5443	390 -924	-7925	19.1
12208	2"	12	1500	3000	6274	365 -645	-13210	43.0
12220	2"	12	3000	5670	8921	812 -980	+2610	19.8
12201	2"	4	1500	2670	5443	364 -616	+2642	39.6
12209	2"	12	1500	2530	5821	420 -644	-18494	19.1
12210	2"	12	1500	1270	4460	476 -644	-15852	44.4
12248	2"	12	3000	3330	5373	-744	-18270	19.1
12250	2"	12	4500	3070	6338	1005 -1405	-23490	19.1
12249	2"	12	3000	2270	5373	485 -1060	-23490	38.7
12251	2"	12	4500	2600	5857	716 -1115	-26100	40.6
12253	2"	16	1500	270	4684	945 -1175	-36540	33.9
12254	2"	24	1500	4930	10540	746 -831	-41760	19.1
12255	2"	24	3000	8600	14329	532 -945	-41760	20.5
12256	2"	24	4500	9130	15018	831 -1261	-39150	21.5

*Just prior to impact.

Figure 6

High Flotation Tire - Obstacle Test								
Record No.	Obstacle Height	Tire Pressure (P.S.I.)	Static Vert. Load (Lbs.)	*Actual Vertical Load (Lbs.)	Peak Loads Occuring at Obstacles			
					Vert. Load (Lbs.)	Drag Load (Lbs.)	Side Moment In. (Lbs.)	Wheel Speed (m.p.h.)
12274	4"	4	1500	1730	4800	-960	10440	20.5
12263	4"	24	1500	4400	11573	-1980	23490	16.0
12282	6"	12	1500	1800	8200	620 -1525	18270	20.0
12285	6"	24	1500	1930	11939	1551 -2115	33930	19.6
12280	6"	12	3000	3130	10800	790 -1380	18270	20.2
12281	6"	12	4000	3750	11601	902 -1890	23490	19.6
12372	6"	4	1500	2130	6067	365 -1410	13050	27.9
12276	6"	12	1500	1800	9067	620 -1551	15660	20.2
12277	6"	12	3000	3400	11467	565 -1380	15660	19.3
12278	6"	12	4000	3330	10533	790 -1580	15660	18.6
12433	8"	3	1200	270	3067	620 -935	10760	6.9
12436	8"	3	1200	330	3000	900 -1020	5380	11.5
12428	4" deep	4	1500	1330	800	680 -535	18830	10.5
12437	4" deep	12	1500	3670	133	735 -650	8070	16.0
12431	8" deep	4	1500	1400	933	765 -735	18830	16.0
12432	12" deep	4	1500	3670	1067	765 -1045	10760	*
12440	12" deep	24	1500	1530	400	850 -480	5380	12.9
12241	12" deep	24	3000	2400	400	595 -170	8070	13.2
12442	12" deep	24	4500	3400	133	790 -510	64550	14.8

* Just prior to impact.

Figure 7

High Flotation Tire - Rolling Tests
Drag versus Vertical Load at Various Tire Press.

Record Number	Vert. Load	Drag Load	Tire Pressure					
12198	2670#	501#	4 PSI					
12245	5130#	1512#	4 PSI					
12247	5470#	1395#	4 PSI					
12204	2200#	639#	12 PSI					
12218	5200#	1037#	12 PSI					
12250	3070#	1686#	12 PSI					
12254	4930#	1512#	24 PSI					
12255	8600#	1366#	24 PSI					
12256	9130#	1221#	24 PSI					

NOTE: THESE READINGS WERE TAKEN
AT THE SAME POINT - JUST BEFORE THE TIRE HIT THE OBSTACLES
DURING ROUGH TERRAIN TESTS.

Figure 8

K&E 10 X 10 TO THE 1/2 INCH 359-11
KEUFFEL & ESSER CO. MADE IN U.S.A.

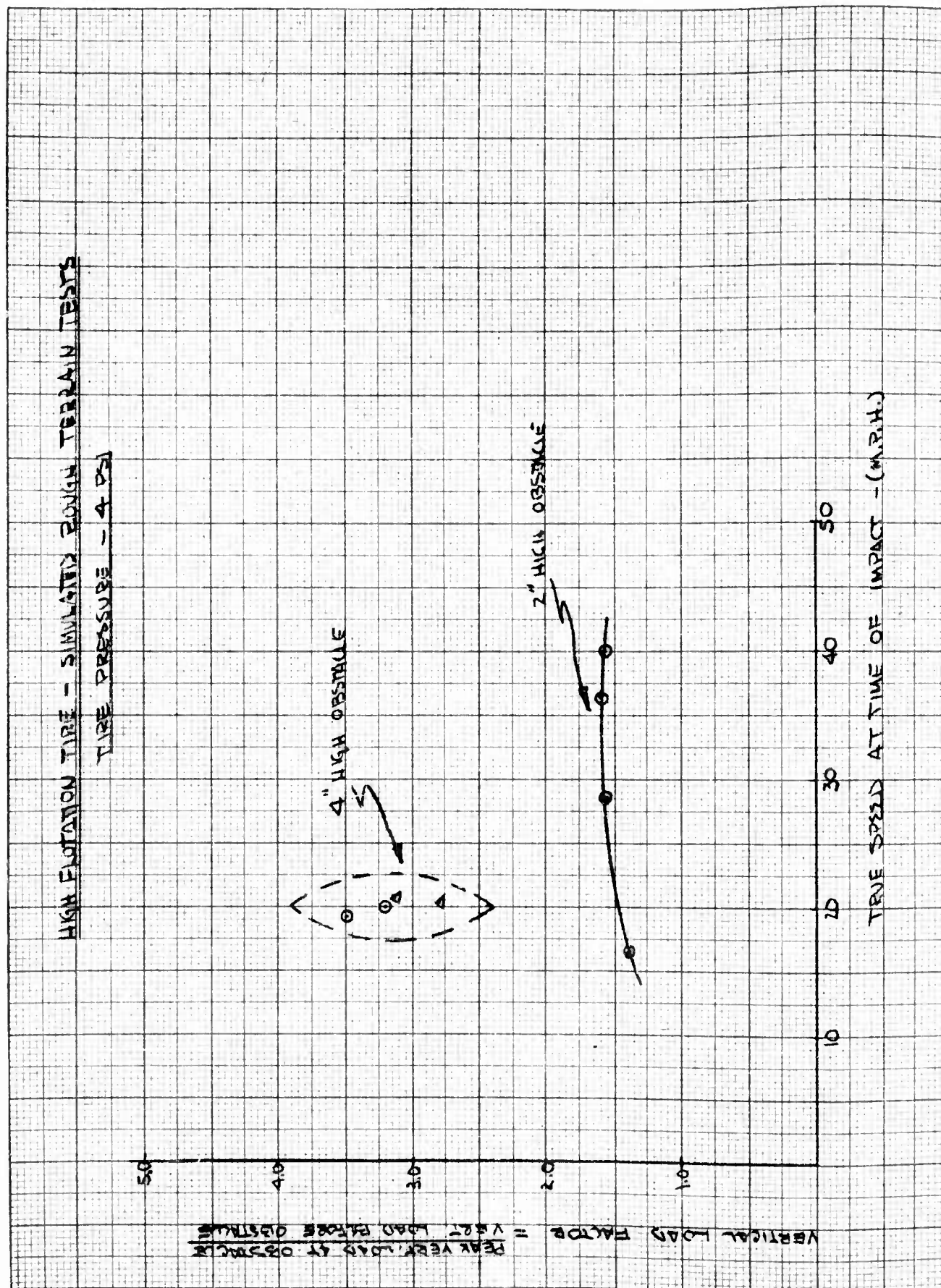
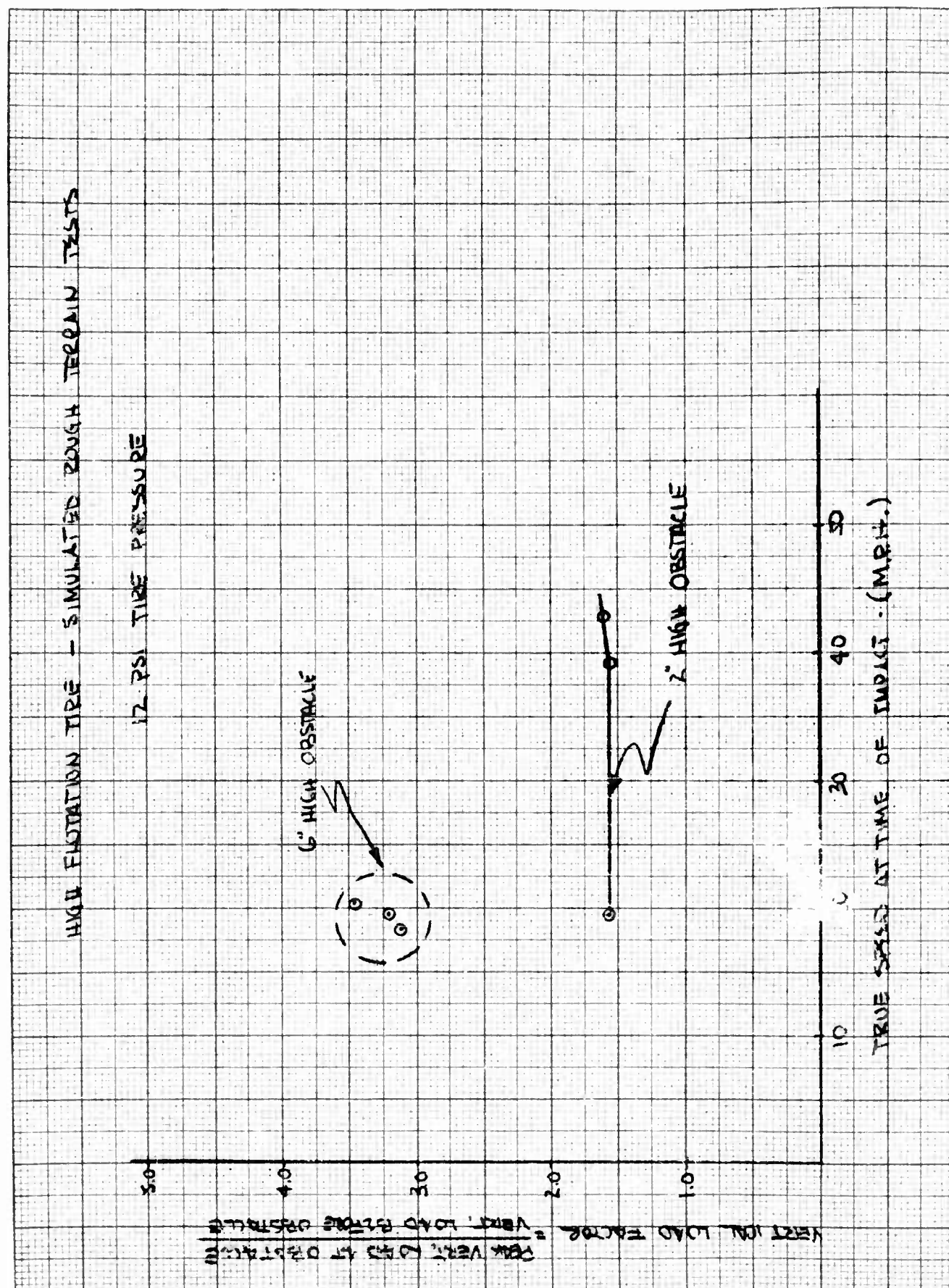


Figure 9

10 X 10 TO THE 1/2 INCH
KUFFEL & ESSER CO.
MADE IN U.S.A.



2. SUMMARIES (Continued)

b. Characteristics of High-Flotation, Foldable Tires (Continued)

(3) The general conclusion drawn from these static and rolling tests was that this model tire would carry successfully all loads which could be improved upon them by landings and taxiing of an L-19 type aircraft unless the structural limitations of the aircraft were exceeded. Therefore, it was also concluded that this model tire was structurally adequate for flight tests on the L-19 and four such tires were built for this purpose.

c. Venting-Hub Shock Absorption

(1) With the results of the preparatory analytical studies as a starting point, a 750-pound, laboratory model, venting-hub, shock absorption system was built and tested. This work is described by Appendix 4, The Design and Development of Laboratory Models to Study the Feasibility of High-Flotation Tires for Aircraft, R245-012. This prototype system made touchdown at relatively high pressure, sensed the vertical load, and opened the vent valve proportionally to the instantaneous load. At a programmed pressure at or near the optimum run-out pressure, the valve actuating mechanism was disconnected and the vent valve closed by spring action. The valves remained closed throughout the remainder of the landing run. To preclude cocking and consequent possibility of initiating an undesired venting upon encounter of an obstacle while taxiing, the system was arranged to be re-cocked only (1) when airborne i. e. there was no vertical load upon the tires and (2) when the tires have been inflated to a pressure just short of that to which they are normally inflated for touchdown. This, incidentally, permits a relatively high taxiing pressure which minimizes rolling resistance and tire wear on smooth pavements. Reliability of the mechanisms was established by approximately 3000 drop tests without spin-up and some 350 additional drop tests with spin-up to touchdown velocity. Landing gear efficiencies comparable to conventional oleo-shock struts were achieved.

2. SUMMARIES (Continued)

c. Venting-Hub Shock Absorption (Continued)

(2) Success with this laboratory model, 750-pound, capacity system led to a decision to adapt a partially designed 1500-pound capacity system to flight tests on an L-19 aircraft test bed. Details of the development of these flight-test venting-hubs are presented by Appendix 5, FAMD Report Number R245-014, "Design and Development of Laboratory and Flight-Test Models of Landing Gear for Aircraft to be Operated from Rough Unprepared Fields." The purpose of the flight tests was to determine the behavior of the tires and venting-hubs under actual landing conditions. These flight tests were made during the winter of 1959-1960 and the summer of 1960. Remarkably close agreement was obtained between the drop tests and the flight tests with respect to sinking speeds versus landing load factors. Details of the flight test program are contained in Appendix 6, FAMD Report Number FT 245-1, Initial Flight Tests, High Flotation Landing Gear. Figure 10 shows a plot of sinking speed versus load factor for both drop and flight tests.

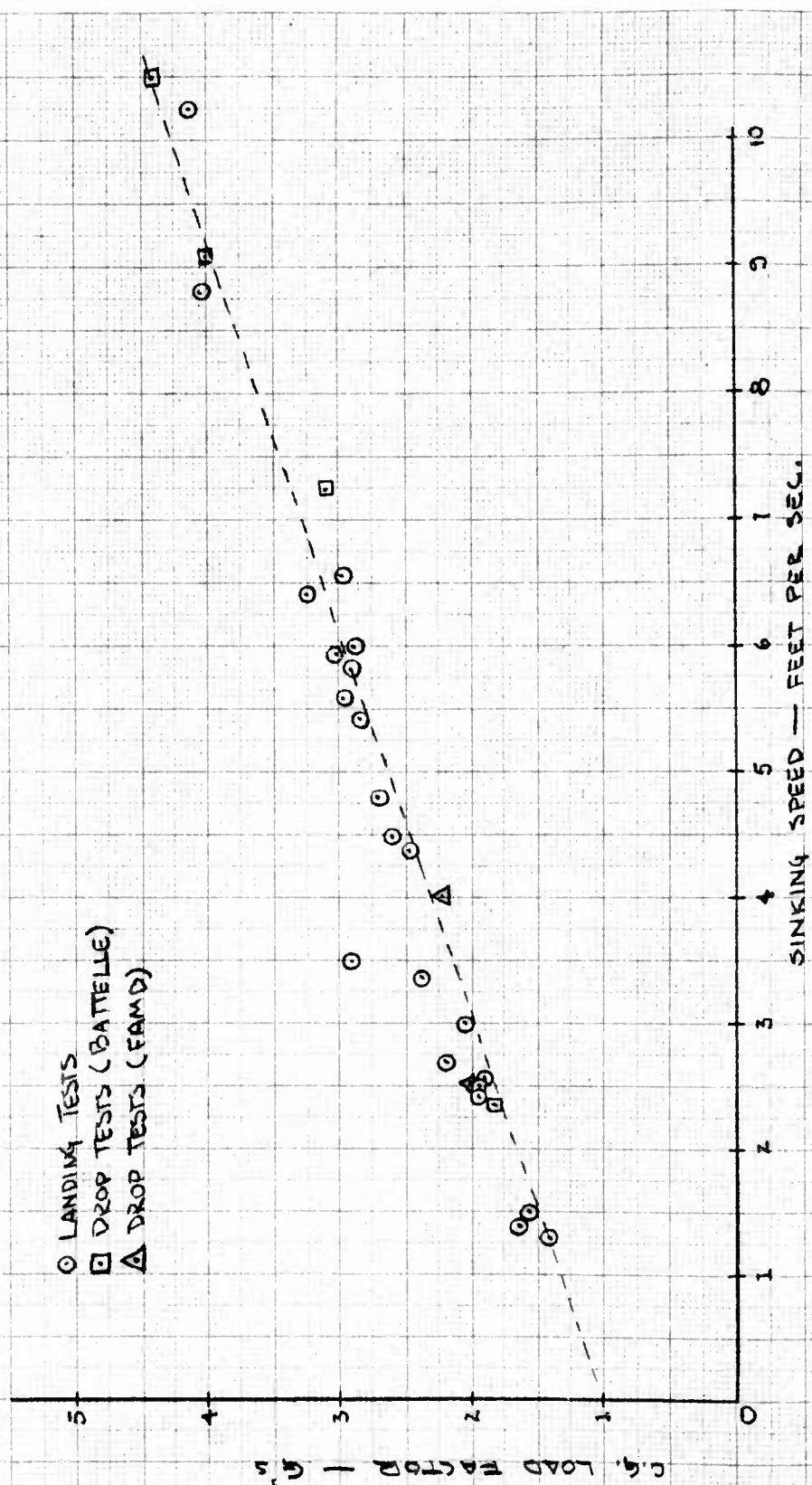
(3) In general, the flight tests confirmed the results of the drop tests and demonstrated the feasibility of suppressing landing rebound of highly deflectable, high-flotation tires by the venting hub technique. The test bed used did not permit installation of a high-flotation tire on the tail gear because of limitations of gross weight and funding. Thus it was not practical to use this test bed for exploration of the capabilities of the system by landings and take-offs from rough, unprepared fields. It was considered that the small, high-pressure tail wheel, mounted on an undamped spring, would have presented a high probability of serious accident under these conditions.

Figure 10

MZ45B HIGH FLOATION LANDING GEAR TESTS

WITH L-19A AIRCRAFT

SINKING SPEED VS. C.G. LOAD FACTOR



2. SUMMARIES (Continued)

d. Tire Folding in a Slip Stream

(1) With analytically predicted success, experiments were conducted with a helical bellows tire-folding scheme. The carcass of a 43-inch flight-test tire was stiffened by cemented-on V-belts in circles concentric to each hub and in a symmetric array across the tread area of the tire between the circles. The path of these semi-circular stiffening ribs can be seen from the long transverse scars on the surface of the inflated tire shown by Figure 11. Their path was skewed to the axis of the tire about 10 degrees. When a vacuum is applied to a thin-walled, continuously-wound-cord tire stiffened in this manner, the tire creases inwardly between the transverse stiffening ribs, developing a helical pattern of folds. As these folds progress, they exert opposite torque on the hubs, and one hub is permitted to rotate. This initial movement causes a progressive reduction in diameter of the tire as the helical bellows are formed. After about a quarter of a turn, the outward component of force on the free hub is reduced relative to the rotating force and atmospheric pressure forces the hub toward its mate. The tire is now committed to symmetric folding and, when completed, the effective width is reduced to approximately three-eighths or slightly less of the inflated width and the diameter to slightly more than the inflated diameter. With a tire of a cross-section represented by two circles tangent to each other at the rolling axis, ten transverse stiffening ribs will permit a reduction in diameter to approximately one-half. With a greater number of transverse stiffening ribs it may be deduced that the folded diameter can be reduced to less than one-half.

(2) When tested in a slip stream at about 100 knots, it was found that cemented-on V-belts did not provide sufficient stiffening to preclude collapse of the leading edge of the tire against the axle when a vacuum was applied. In addition, study of moving pictures of the folding sequence conducted in the laboratory led to the conclusion that the permanent stiffness provided by V-belts (or molded on ribs) would interfere with folding to a minimum package. Accordingly, experiments were

2. SUMMARIES (Continued)

d. Tire Folding in a Slip Stream (Continued)

conducted with an array of pneumatically inflated tubes inside the tire in the same pattern as described above for the cemented-on V-belts. Control of the inflation pressure, and consequently of the stiffness of these inflatable stiffening devices, was independent of the inflation pressure of the tire. This system was tested at approximately 95 knots extended below the belly of a C-119 type aircraft and successful folding was achieved. The folded package was of the same dimensions and symmetry as achieved in the laboratory. Figures 11 through 14 are photographs of the first airborne folding sequence with the stiffening tubes inflated initially to approximately 25 pounds per square inch. Later tests at higher initial pressure in the stiffening tubes resulted in less partial collapse of the tubes on the forward side of the tire and slightly faster folding. It was deduced that higher pressures in the stiffening tubes would permit symmetric folding at higher aircraft speeds and probably would reduce folding time. This successful demonstration of airborne folding in a slip stream concluded the testing.

Figure 11

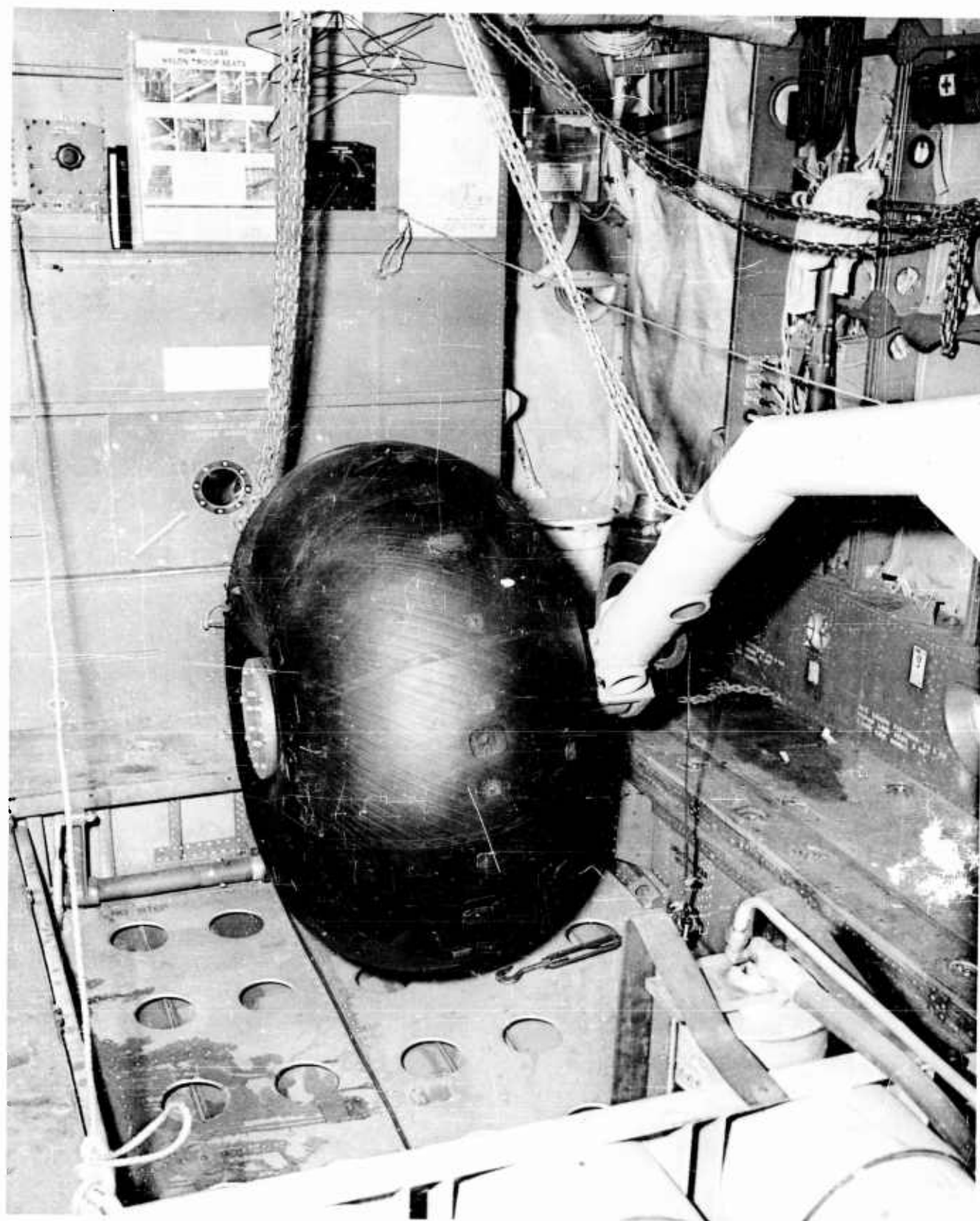


Figure 12

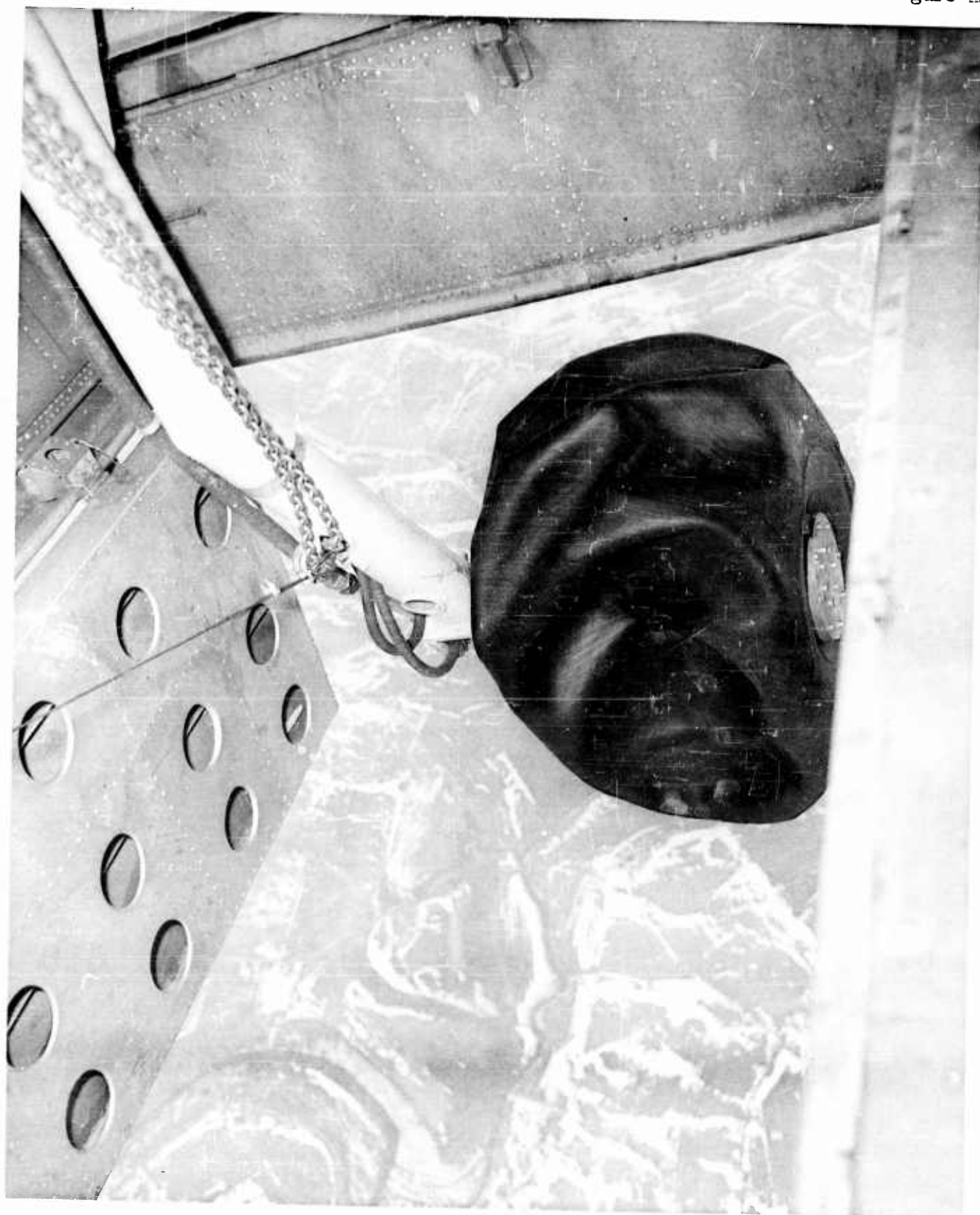


Figure 13



Figure 14



3. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that rough field landing gear can be developed based on foldable, low-pressure tires and it is recommended that the exploratory work reported upon herein be followed by experimental research with a suitably large flying test bed and preferably of operational status.

FAIRCHILD AIRCRAFT AND MISSILES DIVISION

H A G E R S T O W N 10, M A R Y L A N D

SUBJECT DEVELOPMENT OF CONTINUOUSLY-WOUND-CORD

TIRE-BUILDING TECHNIQUES



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REPORT NO. R245.015

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MODEL M-245B

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SUMMARY

Feasibility of production of high-flotation tires by the continuously-wound-cord process has been demonstrated by the work reported on herein.

The techniques presently available for the continuous-cord tire-building need to be refined and the process simplified before production of continuously-wound-tires is programmed.

Analysis of the presently available techniques points clearly towards the path to follow during the evolution of satisfactory manufacturing processes.

Uncertainty in the stress distribution in a high-flotation tire carcass when severely deformed under load, indicates that it will be necessary to use empirical methods in the refinement of high-flotation tire design.

INTRODUCTION

This report presents the results of experiments to date directed towards development of techniques for the building of high-flotation tires of continuously-wound-cord. The contemplated end use of such tires is for STOL aircraft intended to be operated from rough unprepared fields, thus minimum tire weight is of great significance. Feasibility of the continuously-wound-cord method was predicted by the referenced reports of the Battelle Memorial Institute. At the writing a total of 24 tires have been built by the continuously-wound-cord method.

The main body of this report will be focused on the techniques used for the production of high-flotation tires No. 9 through 24. This main body presents the present state-of-the-art. It consists of a chart showing the sequence of steps in the tire-building operation followed by a series of photographs of the specially-developed equipment and descriptions of its use. During the production of these last 16 tires substantially no changes were made in the techniques employed.

Appendix A contains a description of the experimental work of building tires 1 through 8. This work resulted in the techniques employed for building the last 16 tires. During the building of tires 1 through 8, the major problems of techniques were recognized and interim, workable solutions found to overcome them. These solutions are considered interim because they are based on minimum equipment and require maximum hand work and thus tires built by these methods are relatively expensive. Analysis of these methods indicates that the bulk of the hand work could be eliminated by use of more refined equipment and techniques and that production costs using such methods would be equivalent to, or less than, costs of conventional tires of comparable size. Besides demonstrating that it is possible to build light-weight, foldable tires by the continuous-cord method, the work to date has also resulted in guidance for the development of more economical techniques.

The primary purpose of temporarily freezing technique development with tire No. 8 was to produce test lots of tires. At no time has it been concluded that the interim techniques would be suitable for production since the unit cost of tires built by these laboratory methods are too great. During the evolution of these interim techniques, and during building of tires No. 9 through 24, however, considerable thought was given to simplification and streamlining of the processes with view of reduction of manhours

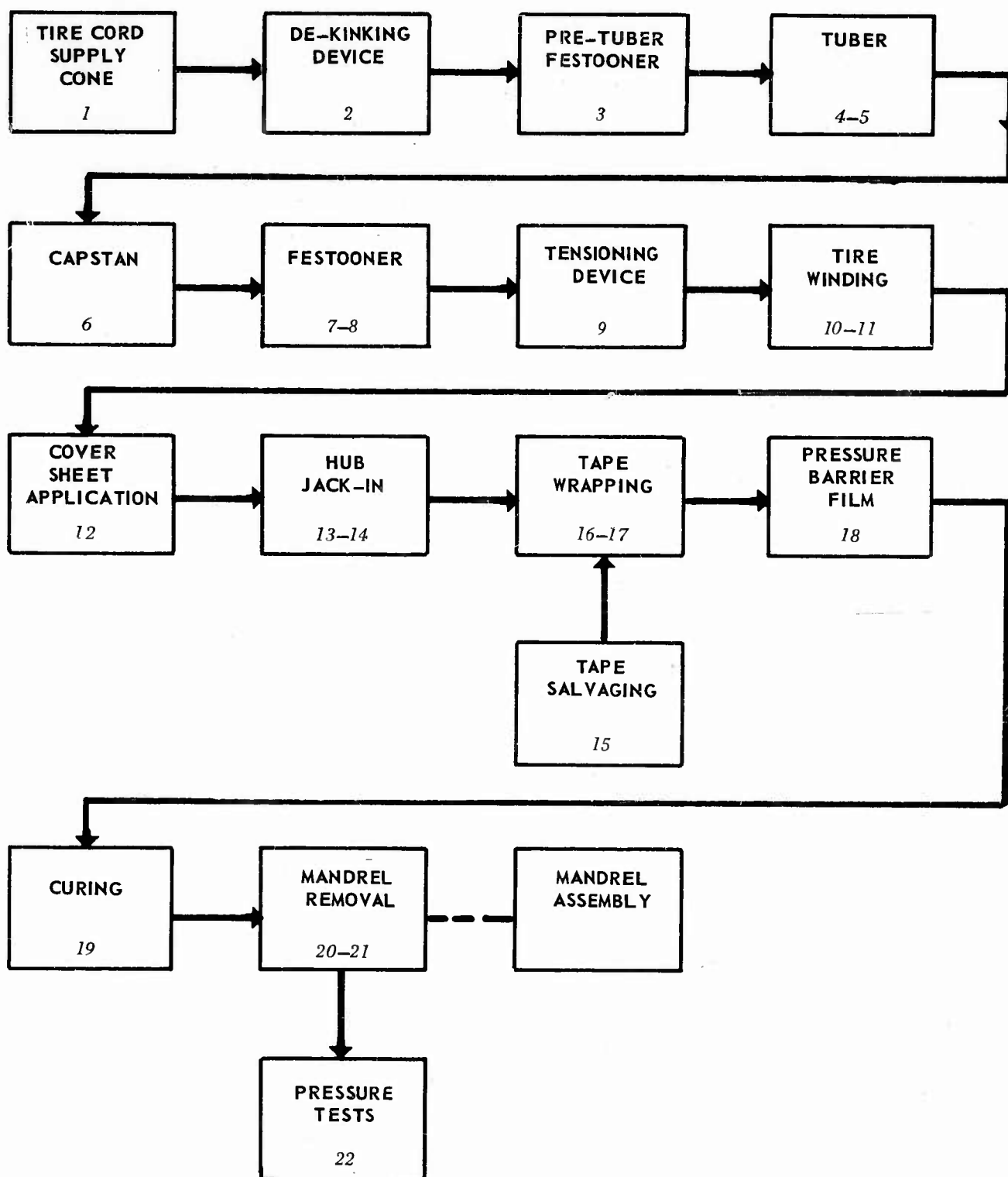
and other costs of the continuously-wound-cord, tire-building process. The results of this thought are summarized at the end of Appendix A.

Appendix B is a summary of background information and discussion of present criteria for design of continuously-wound tires. Due to the uncertainty of the tensile stresses in a high-flotation tire carcass when deformed severely during service, the most significant conclusion which may be drawn concerning the continuously-wound-cord tire design at this writing is that the optimum design can be determined only by extensive testing of the tires under service conditions.

Appendix C is a tabulation of the design features of tires No. 10 through 24, included here for guidance of future tire-building technique development.

Appendix D tabulates the references. In general, material contained in the references is not repeated in this report so that fullest understanding of this report is enhanced by prior reading of the references.

SCHEMATIC TIRE-BUILDING



SCHEMATIC TIRE-BUILDING

The arrows on the chart on the facing page trace the path of tire cord from the supply cone, through the various steps in the continuously-wound-cord, tire-building process, to the cured tire. At the bottom is the box representing the pressure testing conducted on the cured tires as the first step in proving tire worth and included here as a matter of convenience.

The numbers at the bottom of each box refer to the like-numbered photographs which follow in the same sequence.

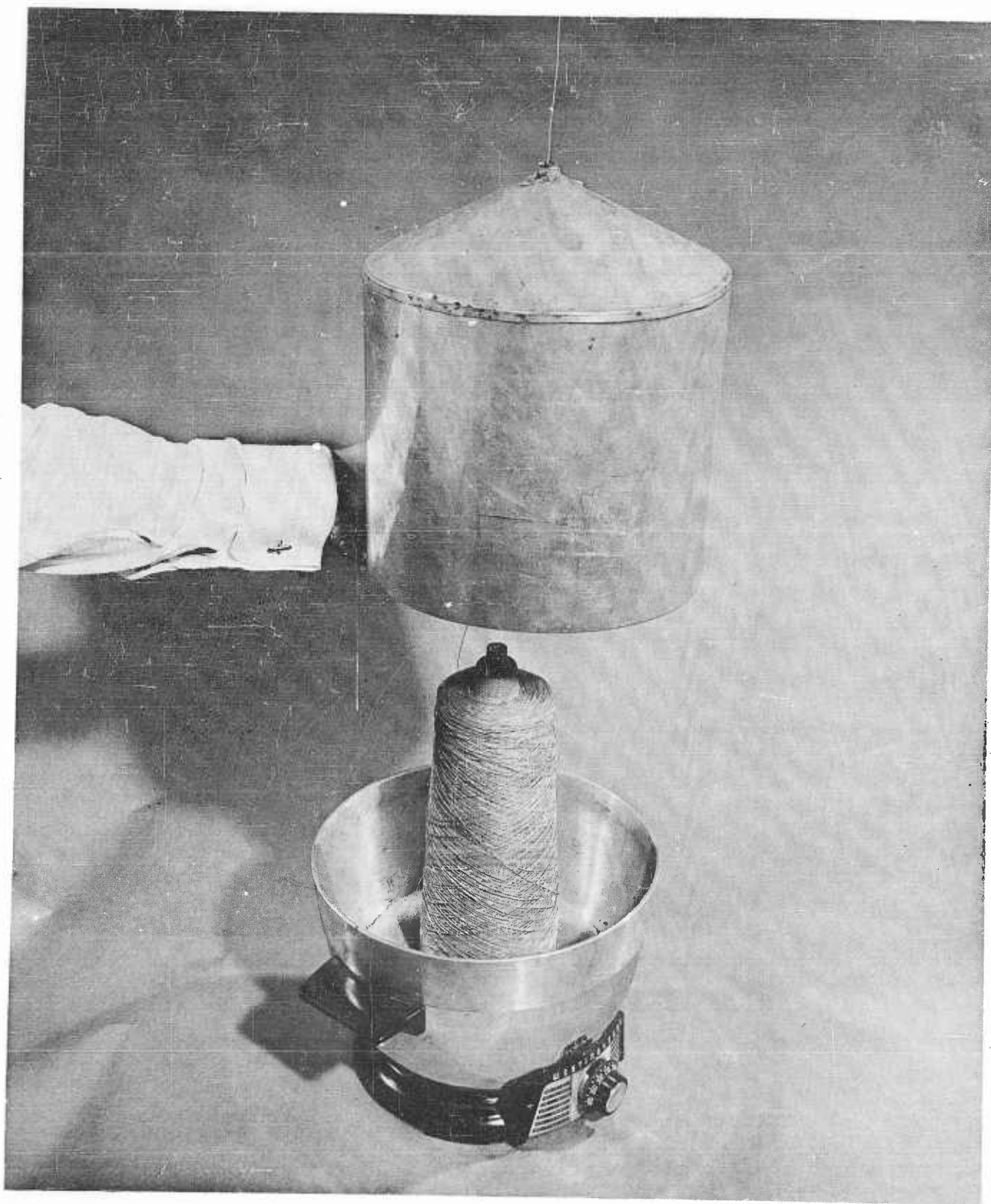


Photo No. 1

TIRE CORD SUPPLY

This photograph shows a cone of nylon tire cord as supplied by the textile industry. The supplier has coated the cord with a resin which promotes adhesion of the nylon to natural rubber. The cone is supported in its upright position by a tightly-fitting metal rod passing axially through the stiff cardboard reel upon which the cord is wound. The base of the cone fits snugly against a sheet of lamb's wool to prevent the cord from being drawn under the base of the cone as it pays off the upper end of the cone and out through the loose-fitting bushing at the top of the sheet-metal cover. The base is an off-the-shelf deep-fat-fryer used to control the temperature of the cord.

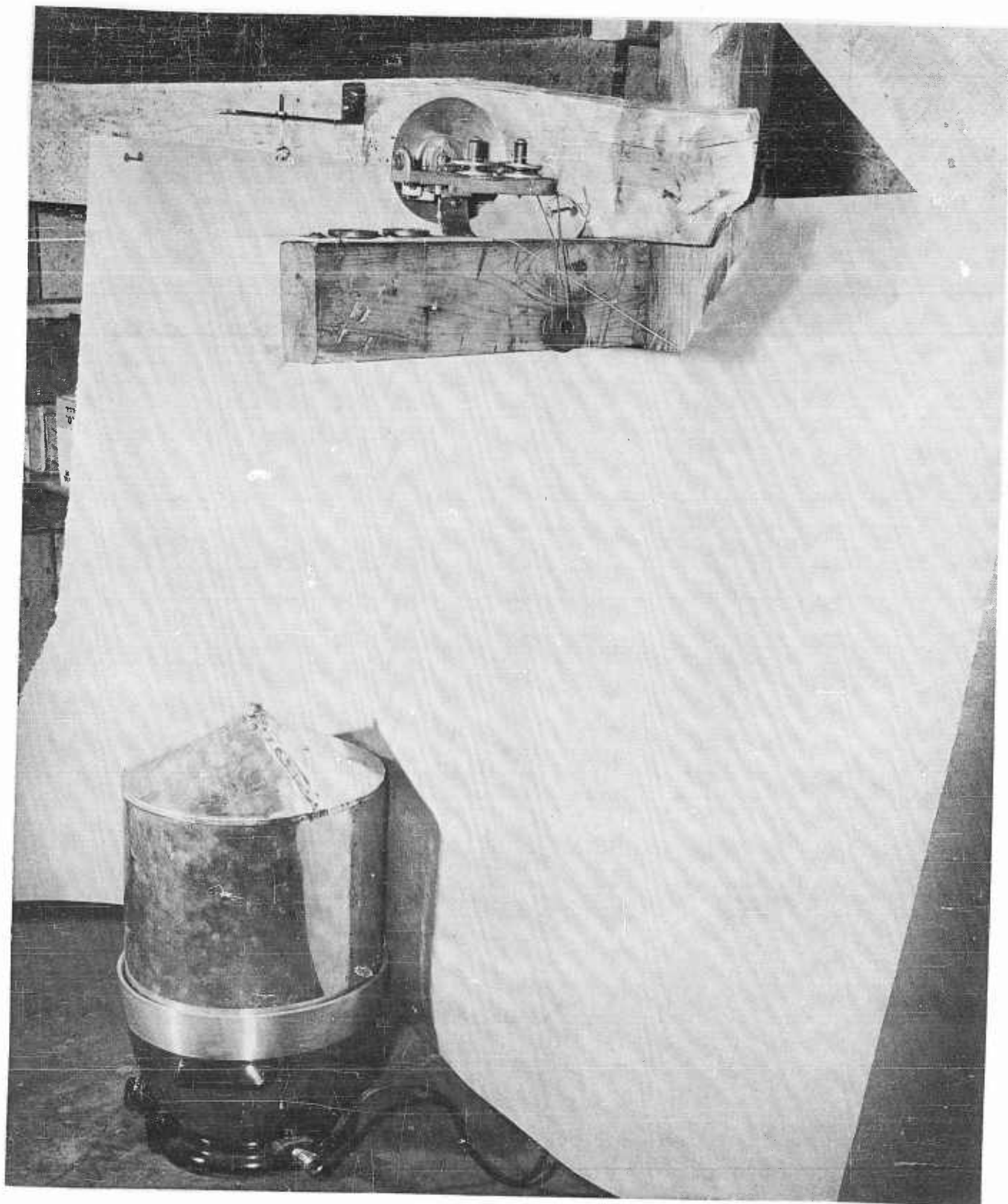


Photo No. 2

DE-KINKER

In this view the sheet-metal cover has been replaced over the cone of tire cord. The cord passes upward through the bushing in the top of the cover, through the eye supported by the bracket, thence to the right and through the de-kinker and finally out of the picture to the left. The de-kinker is a device which smoothes out any kinks which may form in the cord as it pays off the cone at a rate up to 500 feet per minute. In the de-kinker the cord passes alternately around two vertical, hardened steel pins and between two, polished, rounded-edged bushings supported by each pin. These bushings can be loaded with washers to control the minimum tension in the cord between the de-kinker and the supply cone.

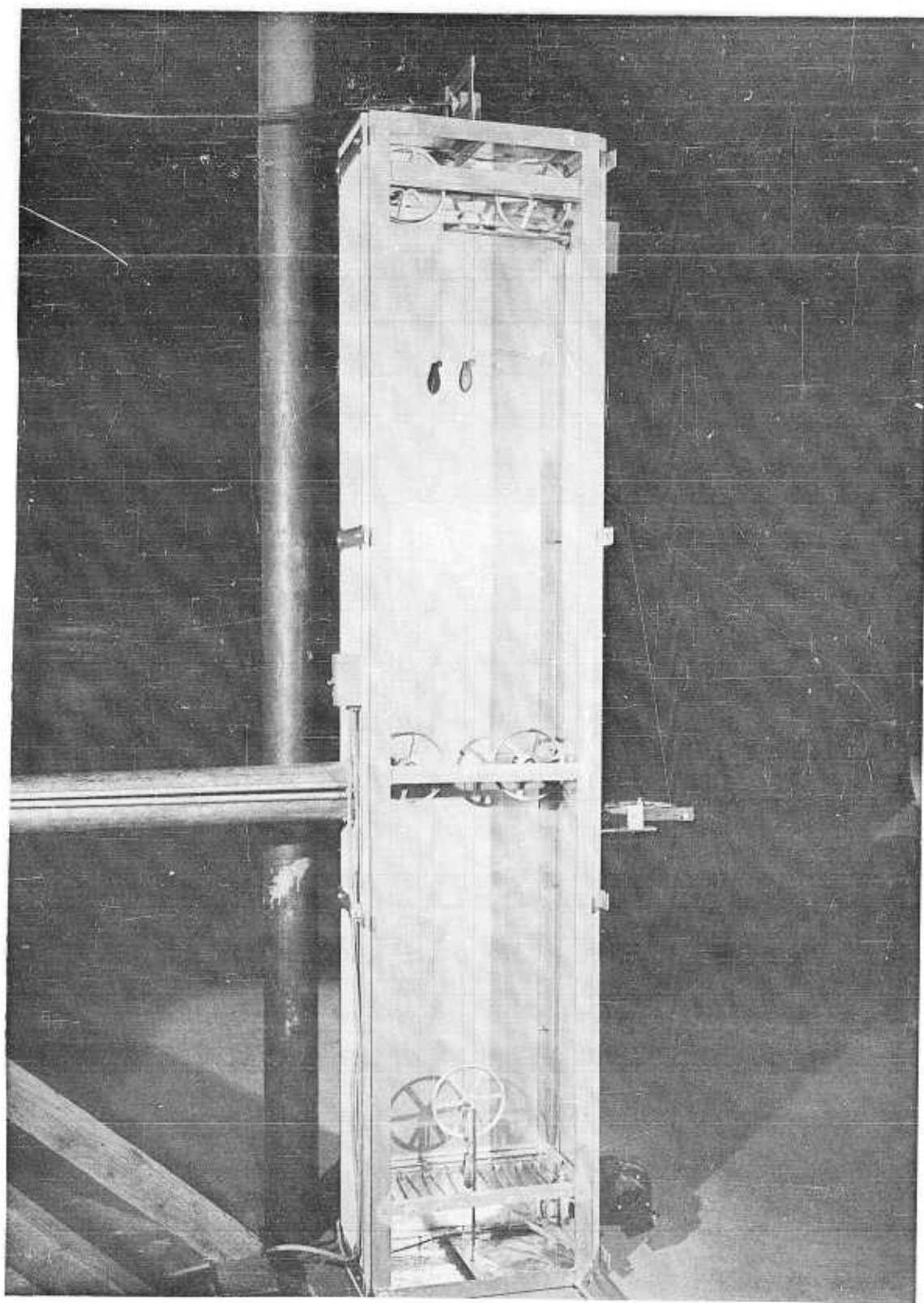


Photo No. 3

PRE-TUBER FESTOONER

This device, shown with the front cover removed, performs two functions. Primarily, it heats the tire cord just prior to its passage through the extruder (hereafter called "tuber" in consonance with jargon of the rubber industry) in order to secure maximum adhesion of the rubber to the cord. The heat is provided by resistance elements at the bottom of the cabinet. The temperature is controlled by a thermostat at the top. The cord is further exposed to the heated air after it leaves the cabinet by the draft from a blower with intake at lower right. The heated air exhausts through the tube at the left which leads to a point near the entrance die of the tuber.

Secondarily, this machine avoids a prolonged suspension of tire-winding caused by knots or kinks attempting to pass through the entrance die of the tuber and a consequent breaking and unreeving of the cord. This is achieved as follows. The cord enters the cabinet after passing through a slot bushing at the right side and around a vertical-axis pulley; thence it passes under the fixed pulley at mid-height on the right; over the fixed pulley at upper right; then down and under the weighted, moveable pulley at the bottom, thence over the fixed pulley at upper left; and finally, after passing under the fixed pulley at mid-height on the left, passes to the tuber through the tube extending to the left of the cabinet. When a knot or kink is caught by the slot bushing, the weighted, moveable pulley at the bottom is caused to rise upward on its guide wires. When this moveable pulley lifts the weight shown suspended on one of the guide wires near the top of the cabinet, a micro-switch opens and all power is shut off, stopping the movement of the cord and preventing a break. A simple kink can then be straightened out and winding resumed. A knot can be cut out of the cord and the cord rethreaded through the tuber without unreeving any of the pulleys.

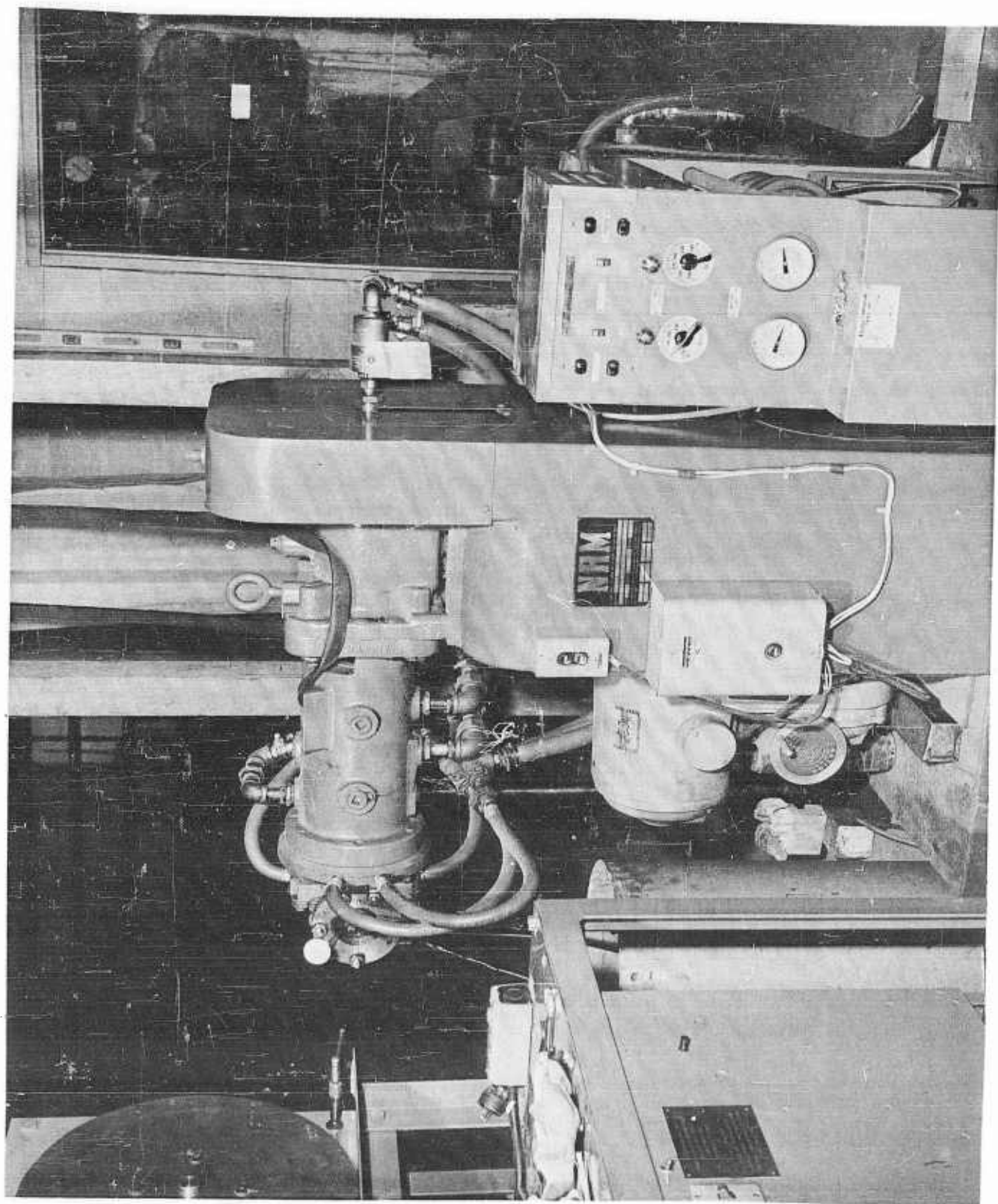


Photo No. 4

TUBER

This view shows both the tuber (identified by the NRM name-plate) and its temperature control unit to the right. This equipment coats the tire cord with fresh, green, tacky, uncured, carcass-stock rubber. Prior to operation, the temperature of the barrel of the tuber must be raised to approximately 85°F. in order to prevent overloading of the masticating worm in the barrel. Rubber stock of about one inch of cross section area can then be fed into the barrel through the loading port just to the left of the lifting eye of the top of the tuber. When the tuber starts grinding the rubber, considerable heat is produced and the temperature control unit maintains the pre-set barrel temperature by cooling the barrel with cold water from the domestic service mains, wasting a small trickle of heated water. Simultaneously the temperature of the cross-head of the tuber is maintained at a pre-set temperature. A cross-head temperature of 200 - 210°F was found to be optimum with the natural-rubber carcass stock used in these experiments. The geometry and operation of the cross-head will be described in the next view. The tuber must be tended continuously during tire winding.



Photo No. 5

TUBER CROSS-HEAD

This view shows the cross-head of the tuber. In it the pre-heated tire cord is coated with carcass-stock rubber. The cord is shown entering from the end of the tube at the left uncoated and departing coated at the right. The maximum cord velocity successfully coated and wound into a tire was approximately 450 feet per minute. The entrance die of the tuber is cone shaped on its outer surface, the apex of the cone pointing toward the direction of cord movement. The diameter of the axial hole in the entrance die should not be more than 10 or 12 thousandths of an inch greater than the nominal diameter of the cord, otherwise there may be a slow rearward flow of rubber through the die and this may cause the cord to jam in the die, breaking the cord. The exit die has a conical recess matching the cone of the entrance die. An axial distance between the two dies of approximately $\frac{3}{16}$ th of an inch gives optimum coating. Uncured rubber must be fed to the tuber at much greater rate than is actually coated to the cord; otherwise the rubber will remain at the elevated temperature of the cross-head long enough for partial cure. Therefore, provision is made for continuous passage of the semi-liquid rubber through the cross-head perpendicular to the cord movement. This flow is regulated by the pressure exerted by the worm in the barrel and by a valve at the over-flow port. The highest pressure attainable, consistent with uniform cord coating, is desired in order to secure thorough impregnation of the cord.

The rubber which passes through the over-flow port may be cooled down and re-fed to the tuber, thus eventually all being coated on the cord. Since the normal distance between the dies is only about one tenth of an inch, due to the conical shape of the space, there is a very rapid flow of rubber toward the cord at the small end of this conical shaped space. Any foreign matter, such as particles of sand, tend to collect at the exit die and if too large to pass through between the cord and the die, either prevents symmetrical coating or causes the cord to break. Since natural rubber is more likely to have foreign bodies present than synthetic rubber, it may be concluded that synthetic rubbers are more appropriate for use in a tuber than is natural rubber. The cross-section of the rubber coated to the cord should be equal to, or slightly less than, the nominal cross-section of the cord. This amount is probably the minimum necessary for complete impregnation of a tire and thus will minimize weight and thickness of the tire. In the limited number of continuous-cord tire-building experiments conducted to date, precise control of the rubber coated to the cord was never achieved. The amount coated was always greater than desired. A more rapid winding rate or a smaller exit bushing or both might have achieved a thinner coating. The experiments were suspended before these possibilities could be fully explored.

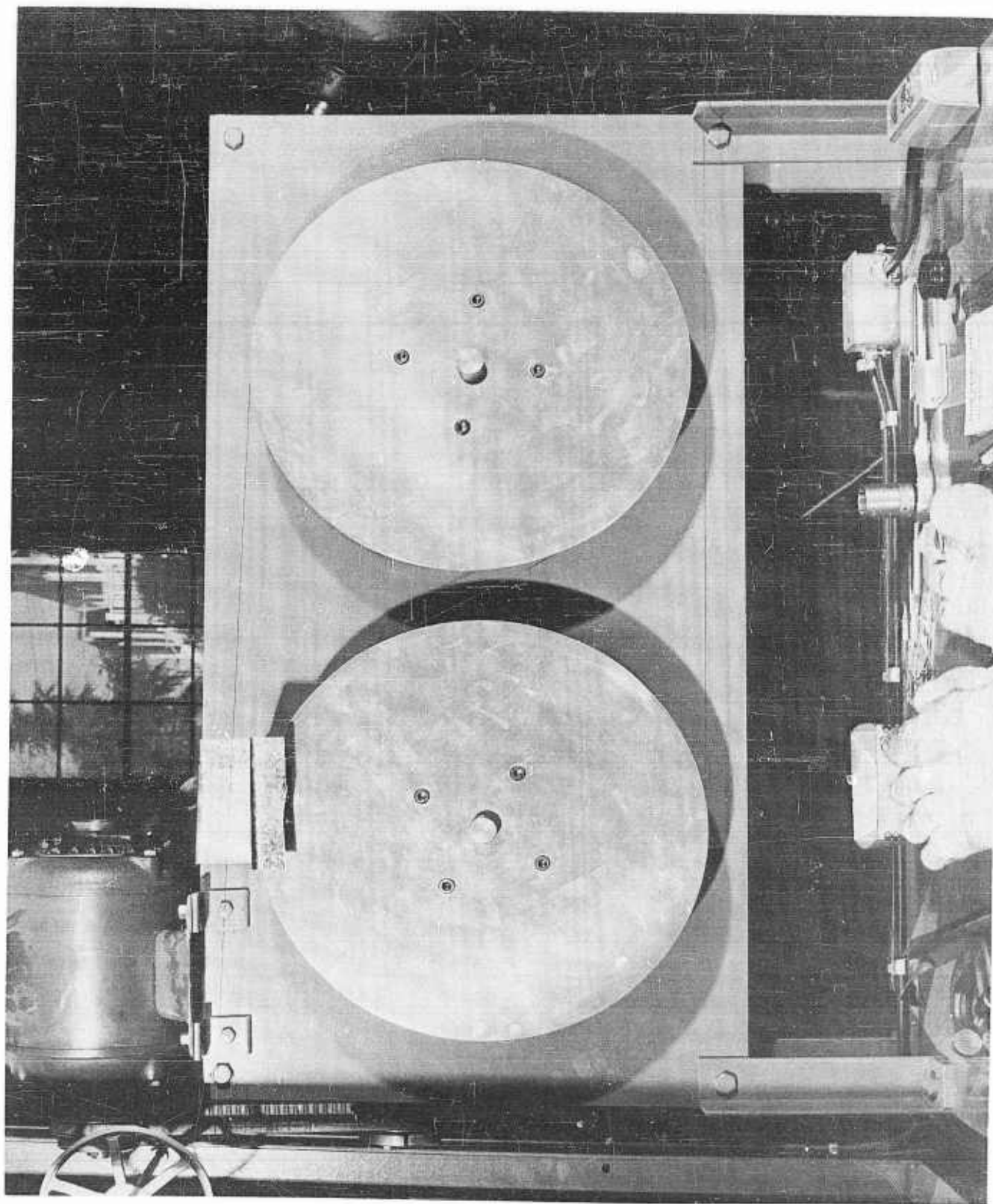


Photo No. 6

CAPSTAN

The coated cord is pulled through the tuber at a tension of up to 8 or 10 pounds by this capstan, passing clockwise around the left drum, down between them and counter-clockwise around the right drum. The drums are grooved to prevent the cord from running off and are driven by the direct current motor mounted above and to the left through a non-slip, toothed, rubber belt, a so-called timing belt. The speed of the motor is controlled by the demand at the winding machine in a manner explained opposite the next photograph.

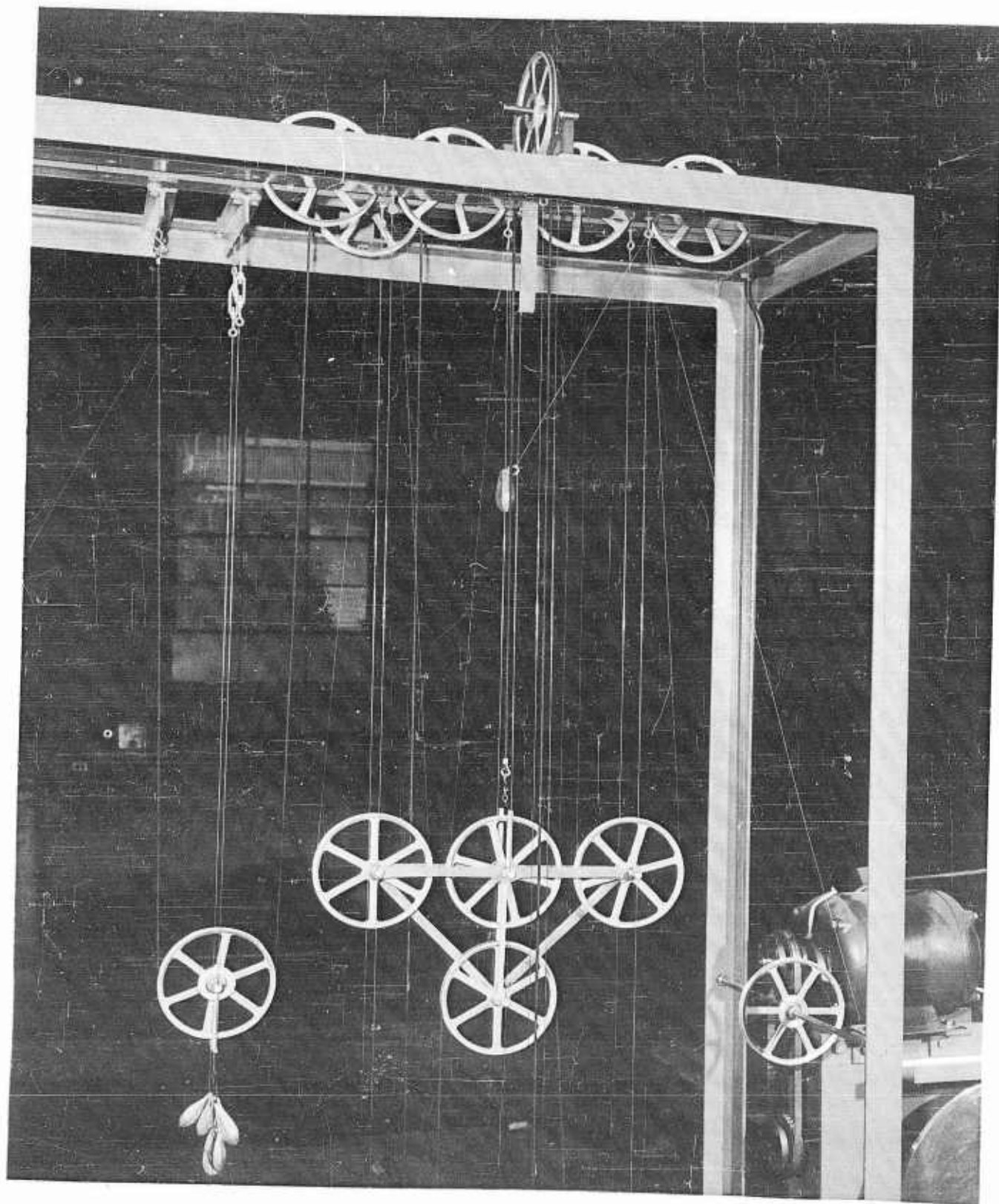


Photo No. 7

FESTOONER

This device provides for synchronization of the winding machine with the capstan, allowing sufficient dynamic storage to permit smooth acceleration of the speed of the winding operation. The cord passes under the pulley at the lower right, thence over the upper pulleys and under the three gang pulleys of the floating array, alternately, and finally down and out of the picture to the left. When the winding machine is speeded up the increased demand causes the floating array to be drawn upward. This causes the rotation of a master selsyn motor and in turn a slave selsyn operates to increase the speed of the direct current motor which drives the capstan and vise-versa. The floating gang pulleys travel up and down on piano wire with negligible friction. This device could be improved by the addition of fair leads for each stationary pulley and by deeper grooves on the sheaves, both improvements tending to inhibit accidental unreeving.

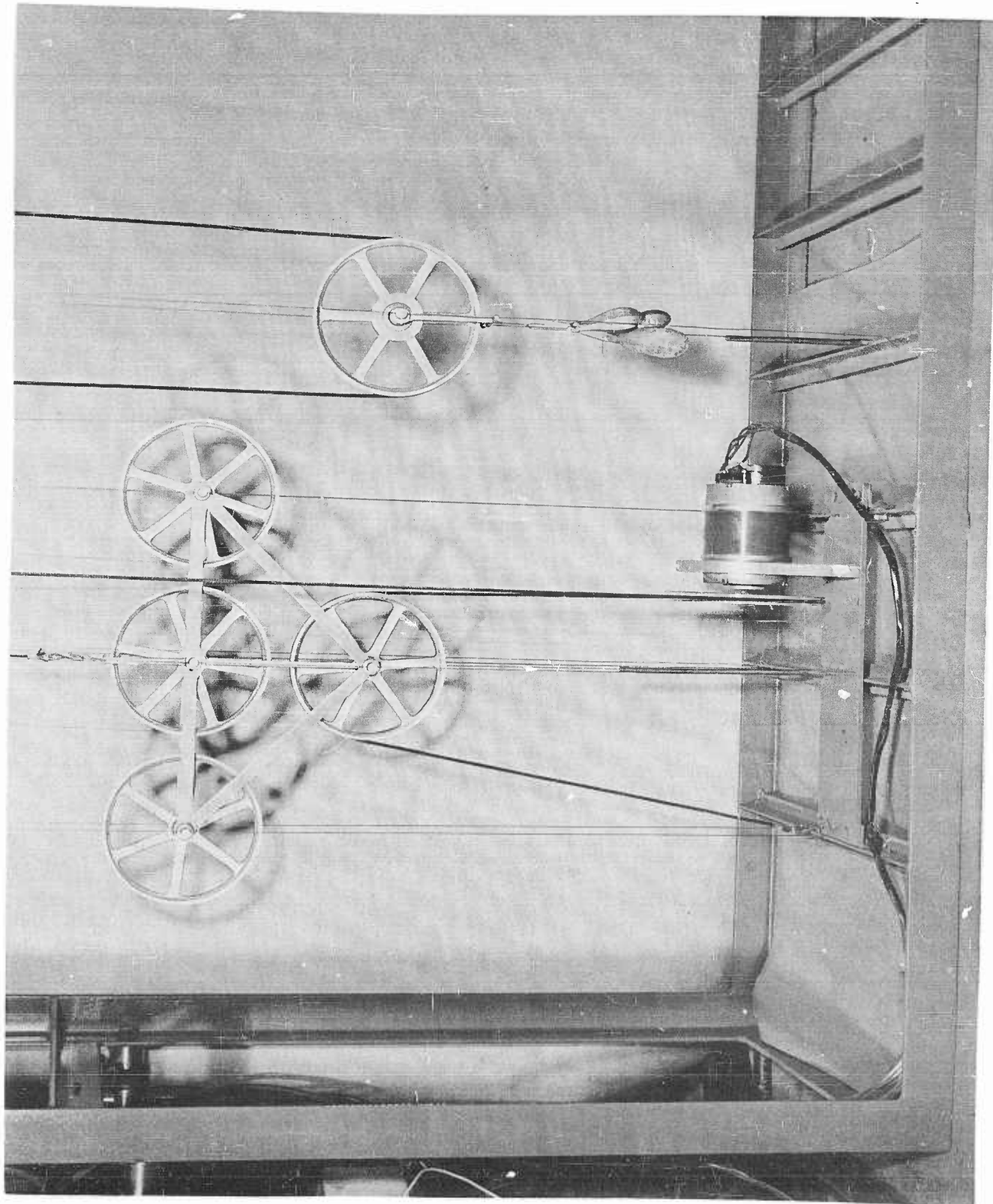


Photo No. 8

MASTER SELSYN MOTOR

Cord tension in the festooner is controlled by the weights attached to the single floating pulley shown at the right. The heavy black cord which passes under this pulley passes over an idler pulley at the top of the frame, thence down and around the pulley on the shaft of the master selsyn motor and then over the lower pulley on the floating gang. Thus an upward or downward movement of the gang pulley causes a rotation of the selsyn motor.

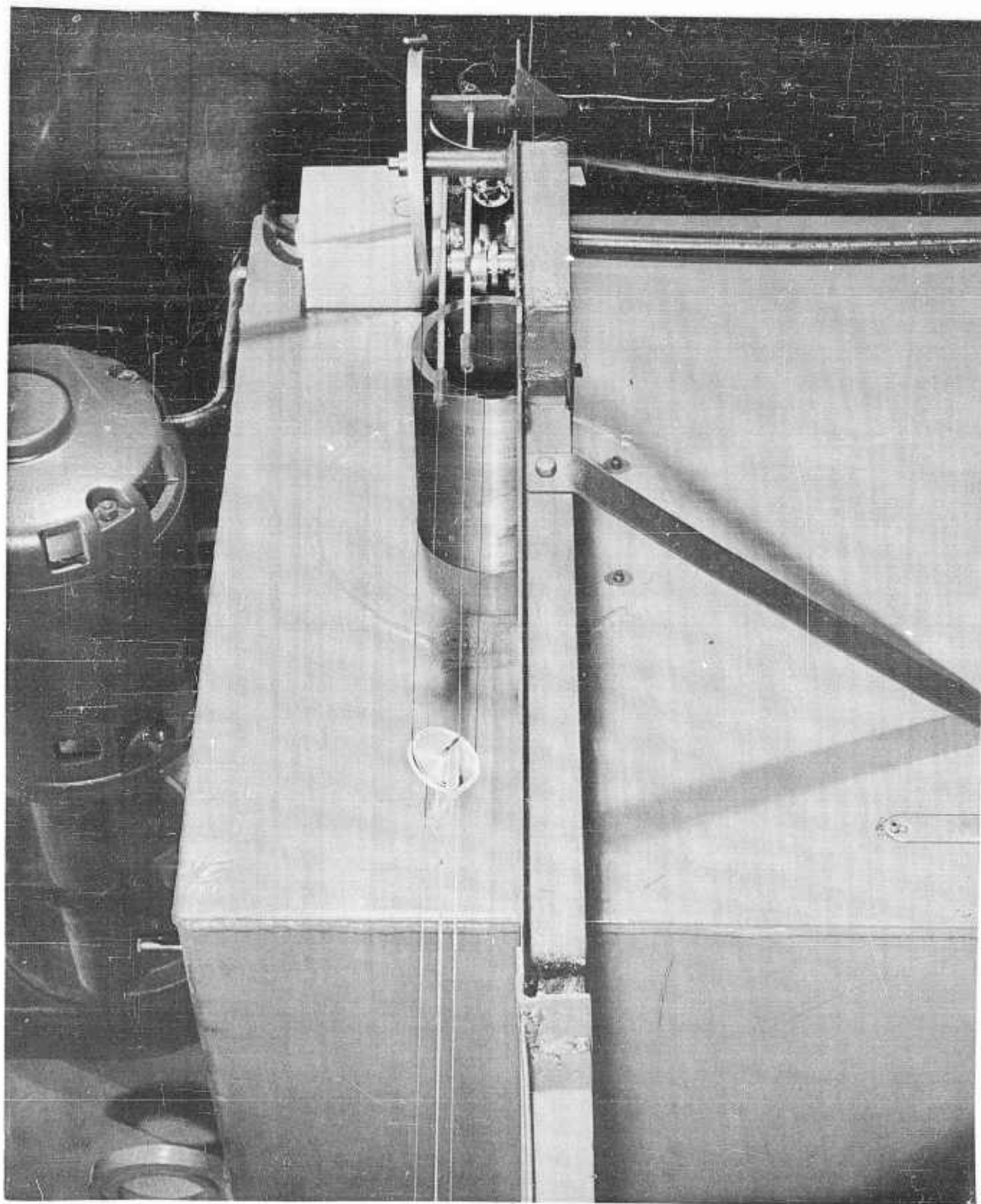


Photo No. 9

FINAL TENSIONING DEVICE

In the winding plane, the surfaces upon which the cord is wound are non-circular. Therefore, with uniform speed of rotation of the winding arm, there is varying velocity in the speed of the cord as it passes the fair loads at the end of the winding arm. If allowed to be transmitted back to the festooner, this varying velocity of the cord causes a cyclic up and down motion of the floating gang pulley and this limits the winding-arm rotational speed to an unacceptably low value. The device shown here smooths out the changes of velocity of the cord at the festooner and maintains a suitably low tension in the cord at the tire. The cord coming from the festooner passes around the vertical-axis pulley at the right, thence around the small, very light-weight, floating pulley in the center, and thence around another vertical-axis pulley and into the hollow axle of the winding arm. The floating pulley is held to the left by a long strand of rubber of the sort used to power model airplanes. Thus the six to ten inch travel of this pulley to and fro, twice for each revolution of the winding arm, causes a negligible change in tension of the cord.

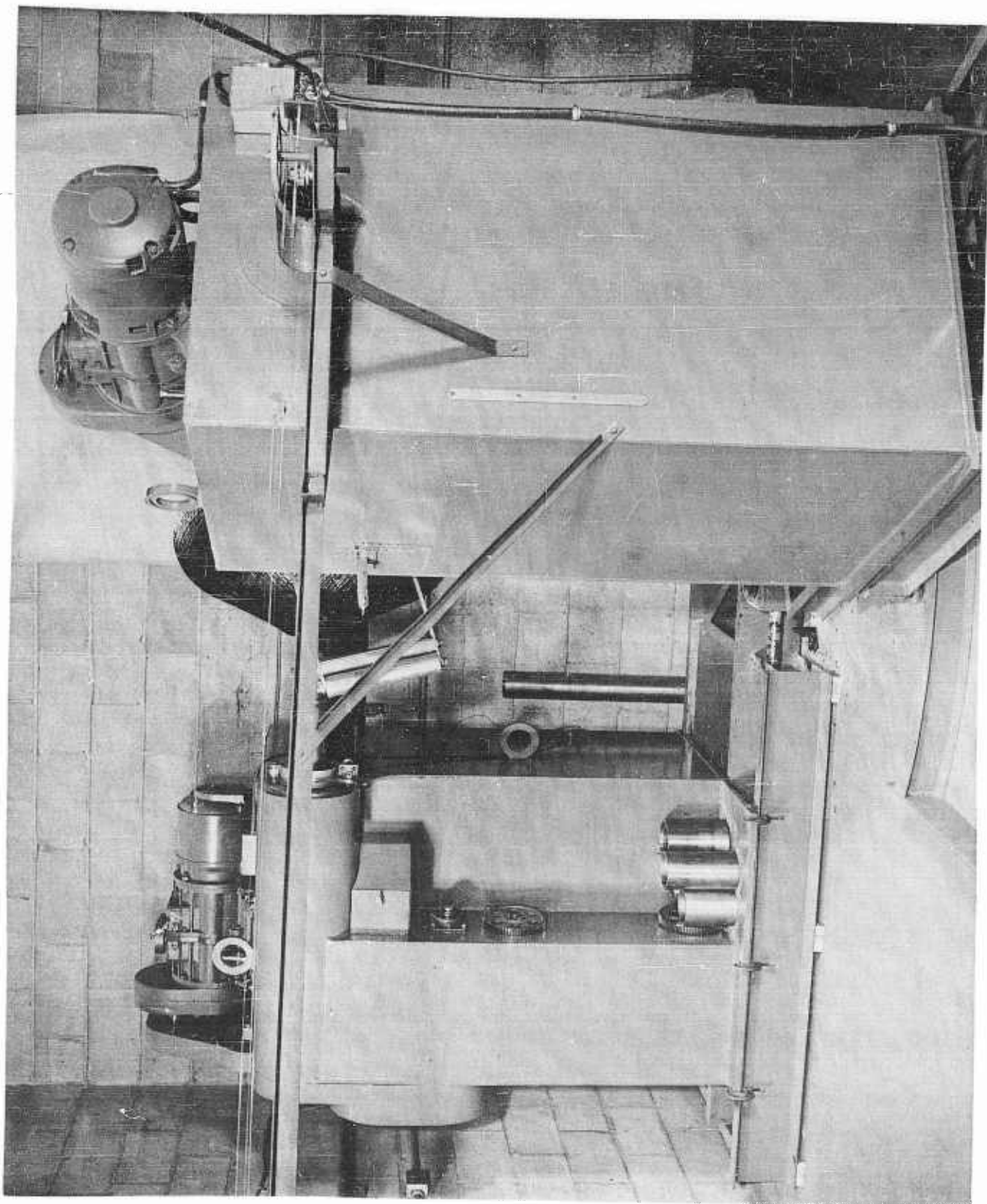


Photo No. 10

WINDING MACHINE - 1

From this view the set-out position of the tire hubs during winding can be observed as well as the shape of the non-circular surface upon which the tire cord is wound. Note also that the angle between the axis of the mandrel and the axis of the winding arm can be varied to accommodate variation in mandrel cross-section, hub diameter or relative speeds of rotation of winding arm and mandrel, all of which will cause a change in the angle between the plane swept by the winding arm and the axis of the mandrel. The correct angle between the axis of the mandrel and the axis of the winding arm can most easily be found by trial. In general, the winding plane should be set so that the cord is tangent to the axle at the hub during winding.

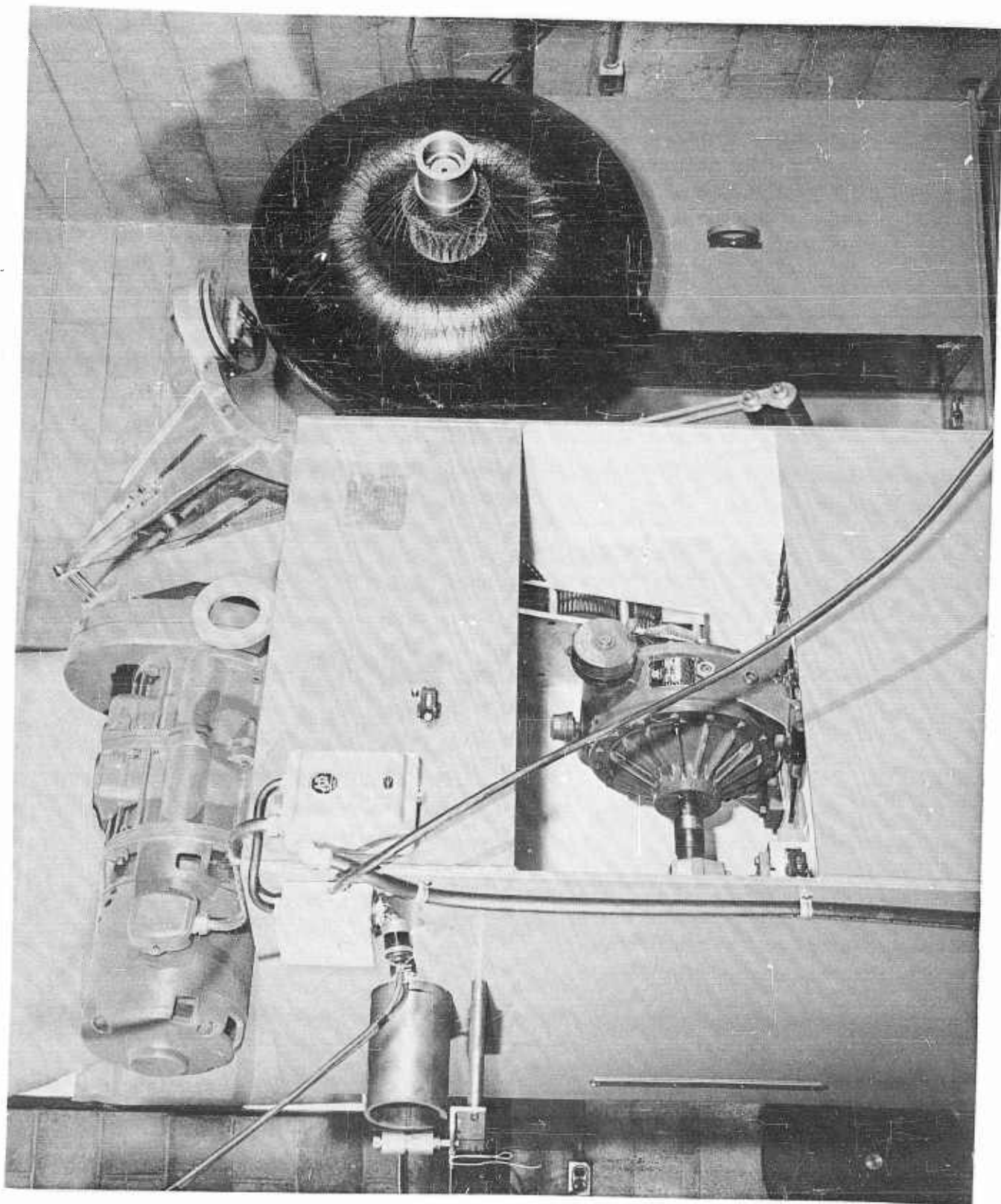


Photo No. 11

WINDING MACHINE - 2

This view of the winding machine shows a tire with only a few dozen turns of cord wound into place. A thin sheet of rubber called a liner has been placed on the mandrel. The liner stock is compounded for minimum permeability to flow of gasses. Notice the set-out position of the hub and the recess in the mandrel which receives the hub prior to cure of the tire. The curved path of the tire cord across the tread area of the tire can also be observed in the upper portion of the tire. This curve can be varied in shape by increasing the clearance of the winding arm above and below the center-line of the tread of the tire, by varying the relative speed of rotation of the mandrel and winding arm, and by varying the angle between the axis of the mandrel and the winding plane. The shape of the curve of the tire cord on the mandrel surface will affect the inflated shape of the cured tire.

As winding progresses there will be a build-up of tire cord on the hub due to its wrapping around the hub while the winding arm rotates with the cord in contact with the hub but not in contact with the mandrel. This build-up will cause a change in tension of the cords of the completed tire unless accommodated for by a small movement of the hubs inward as winding progresses. The amount of movement inward required is determined by tire-cord diameter, total number of turns wound, depth of rubber coated on the cord, and the amount of wrap around on each hub for each turn. While winding a tire, all rotary power is furnished by the electric motor and variable speed drive mounted above the winding arm support. The rotation of the winding arm is carried through idler gears to the shaft of the variable speed drive mechanism shown mounted directly under the hollow axle of the winding arm. From here the power is carried by shafting downward to spur gears, thence parallel to the winding arm axis to a point directly under the center of symmetry of the mandrel where it changes direction to parallel the mandrel axis and thence upward through idlers to the mandrel axis. Once a tire design is standardized, the speed variator mounted under the axle of the winding arm could be changed for fixed gearing, thus removing one possible cause of trouble due to slippage in the friction drive of the speed variator.

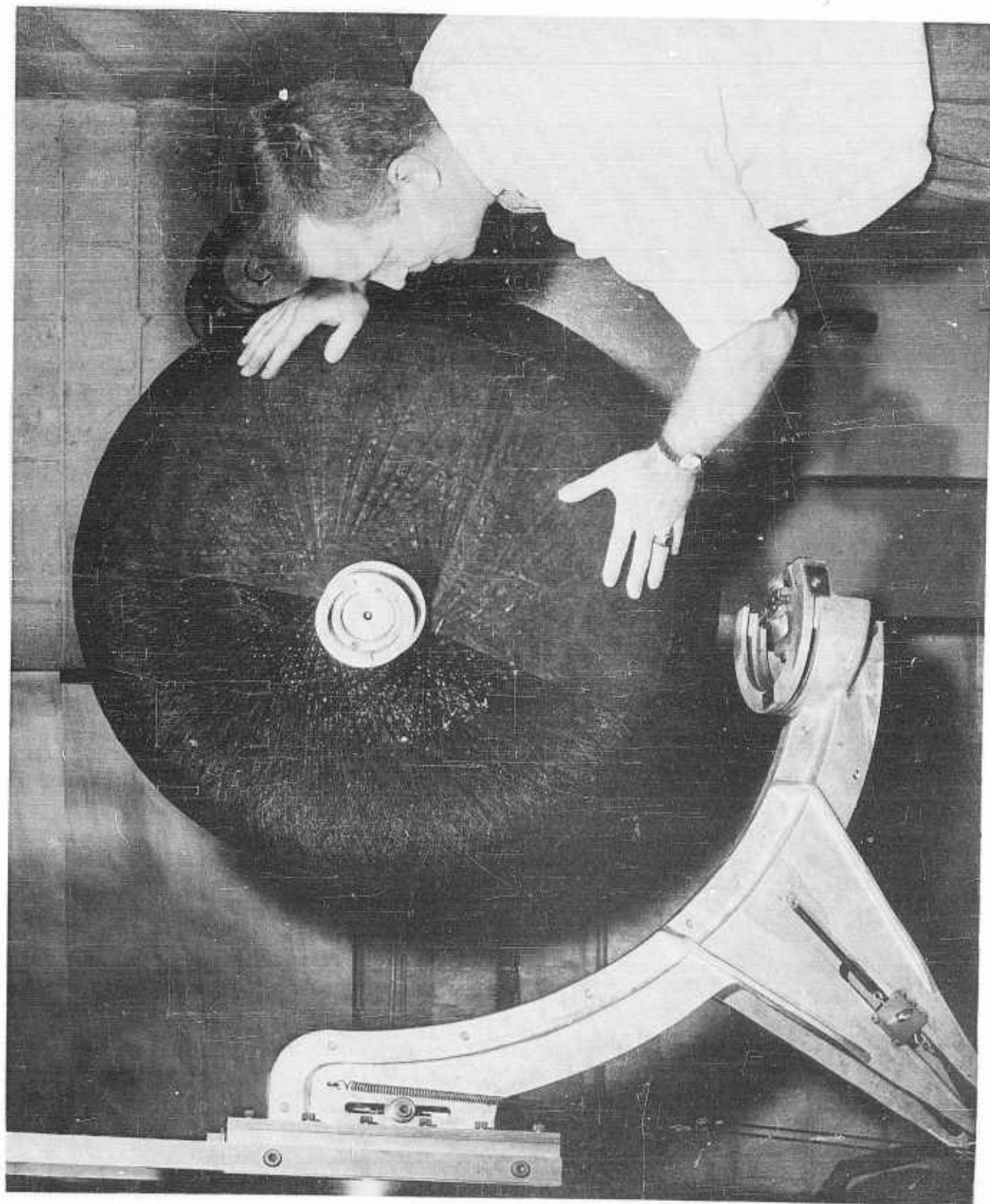


Photo No. 12

COVER SHEET APPLICATION

To provide protection against abrasion a cover sheet of carcass stock rubber, approximately 0.020 inches thick, is applied over the entire surface of the tire after winding is complete. This completes the structure of the tire. Wearing surface or tread is then applied as required by the service life desired.

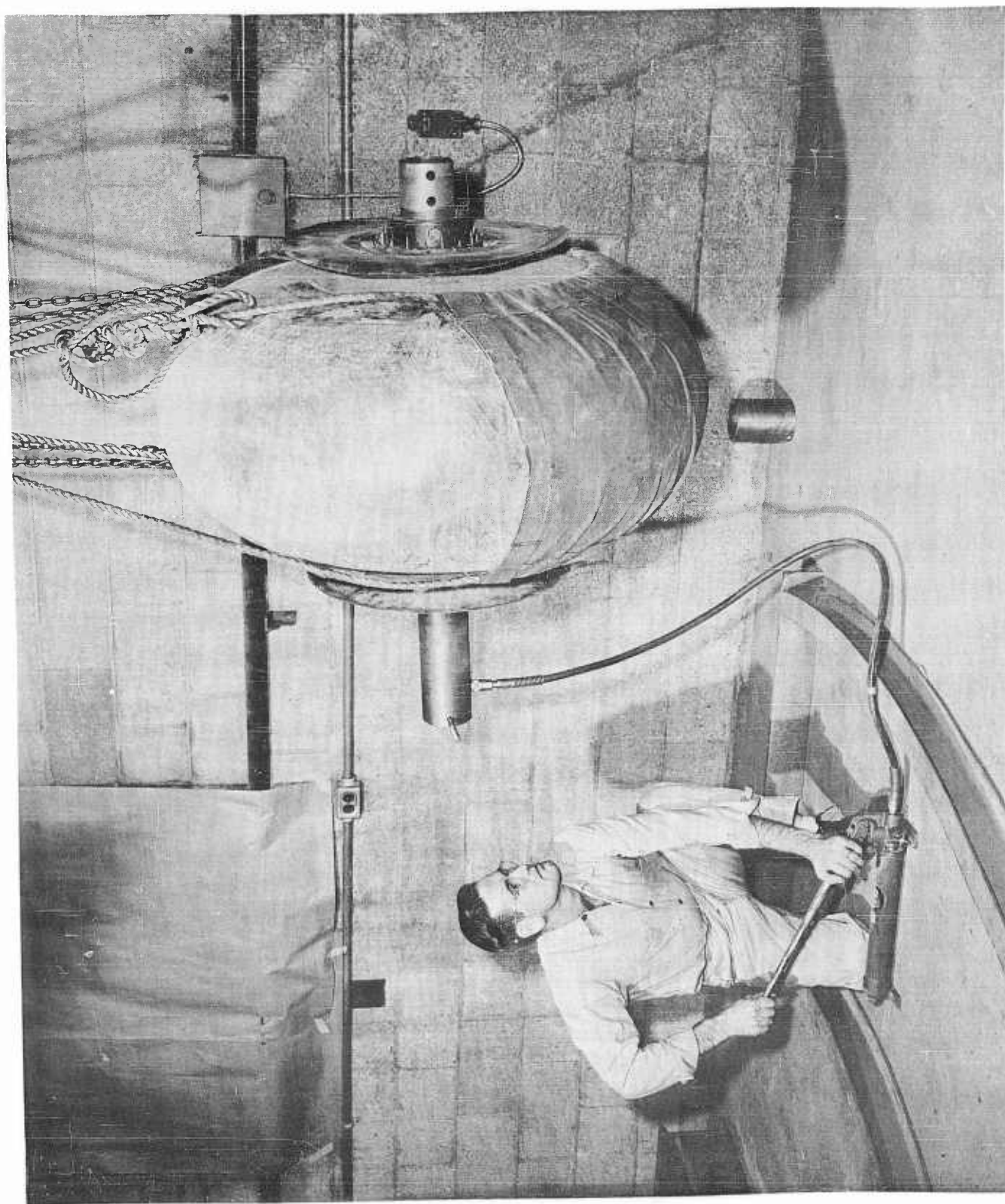


Photo No. 13

JACKING IN THE HUBS

In this tire, winding and cover sheet application have been completed and the tire dusted with talc to prevent adhesion of the tire to the sling. The hubs are being jacked into curing position by a hydraulic jack inside the hollow axle.

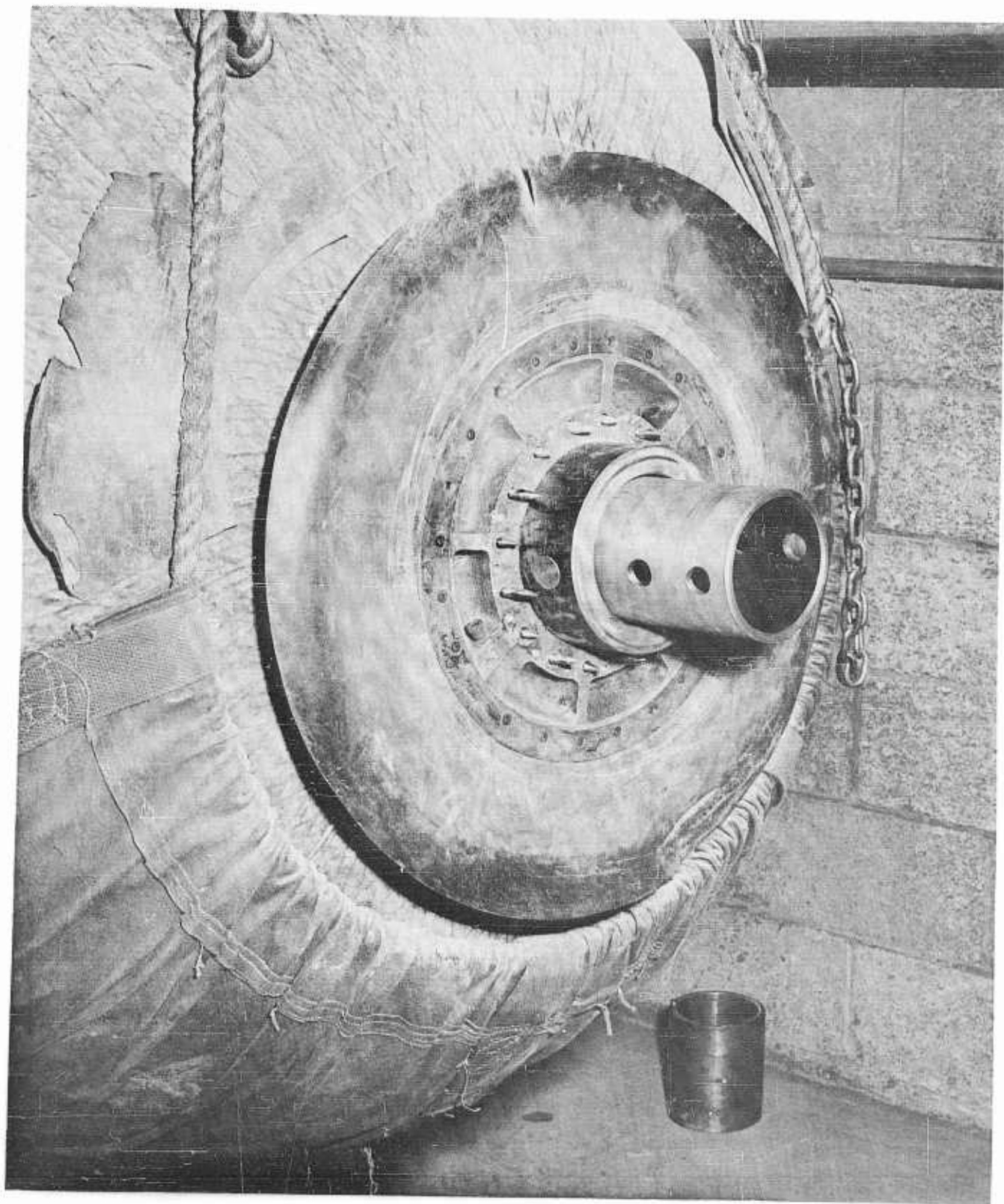


Photo No. 14

Hub Detail

HUB DETAIL

This close-up of a hub being jacked into curing position shows the ends of the pointed rods which form the ring of flange bolt holes concentric to each hub. In the winding position the ends of these rods project just far enough into each hub to prevent the hubs from rotating on the mandrel spindle but not far enough to interfere with symmetric placement of the cord. Notice also that the curing flange has a metal center and a concentric rubber extension which fairs to zero at the shoulder, the widest part of the tire. The inside of the central metal portion of the curing flange is machined on the inside to the contours of the outside of the bead of the tire. Considerable force is needed to squeeze all the air out of the tire near the hub and to compress this bead area into the desired shape. This compression is begun during the preparation for cure and completed while the rubber is softened during the curing process. After the hubs are jacked in as far as practical at this stage, the pointed ends of the rods are unscrewed and replaced by nuts and washers holding the hubs in the jacked-in position.

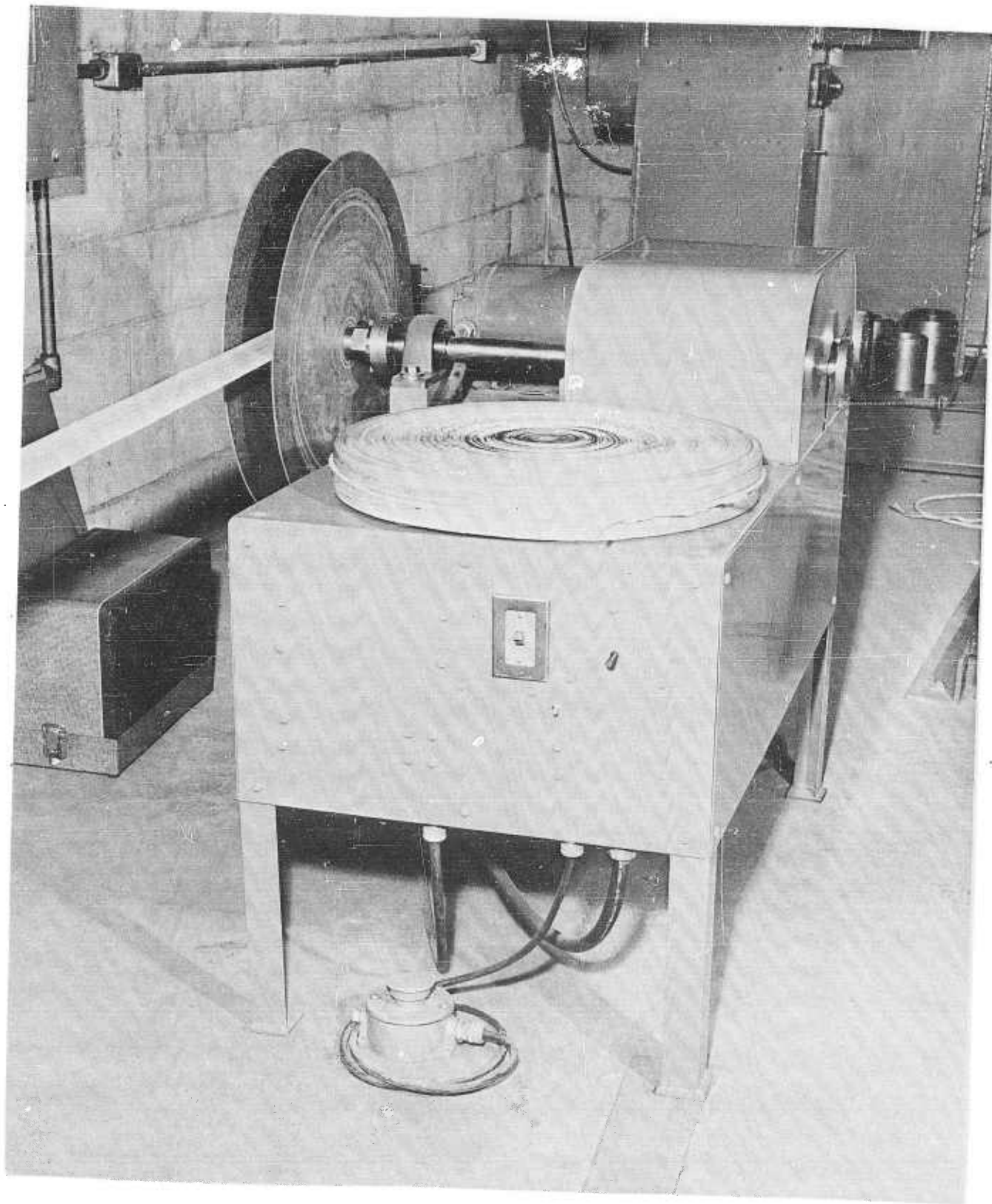


Photo No. 15

CURING TAPE, PREPARATION FOR USE

This view shows the machine developed for re-winding nylon curing tape after it has been pulled at high tension through a series of rollers submerged in hot water containing a silicone, mold-release compound. After use the nylon tape is set to a serpentine shape and must be softened by heat and stretched and moistened before re-use. A roll of tape ready for use is shown lying on the top of the re-winding machine.

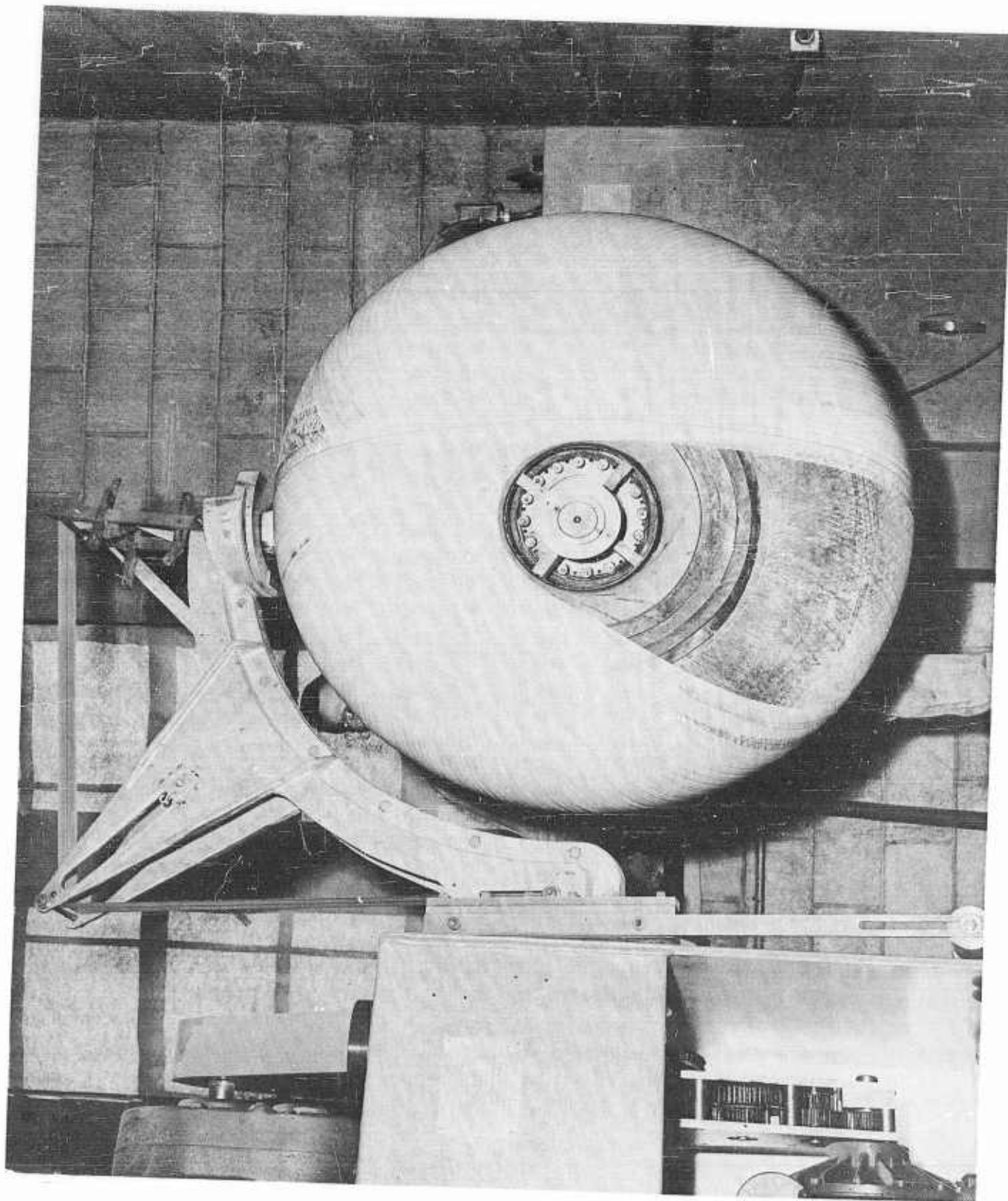


Photo No. 16

NYLON TAPE WRAPPING

After the hubs are jacked-in, and secured by nuts set up on the flange-bolt-hole-forming rods, the assembly is remounted on the winding machine. Flat, flexible, copper washers are placed over the curing flanges concentric to the spindle. These washers cover the inner, metal portion of the curing flanges and extend outward in steps partially covering the flexible, rubber portion. These washers assist in securing a uniform pressure on the tire in the region of the hub during cure. A short length of steel cylinder is shown wedged by wooden blocks concentric to each hub with the inner end bearing against the metal portion of the curing flange. The angle between this stubby cylinder and the curing flange is filleted by an aluminum casting. The assembly is now wrapped with several hundred turns of thin nylon tape about three inches wide and moistened to reduce slipperiness. During this wrapping, the mandrel spindle and winding arm are driven independently at relative speeds which cause about a two thirds overlap of successive layers of tape. This tape, as with all nylon, has the property of shrinking with rising temperature up to the melting point of the nylon and this assures high pressure between the shoulders over the tread area of the tire during cure. The result is sound, dense rubber in this region after cure.

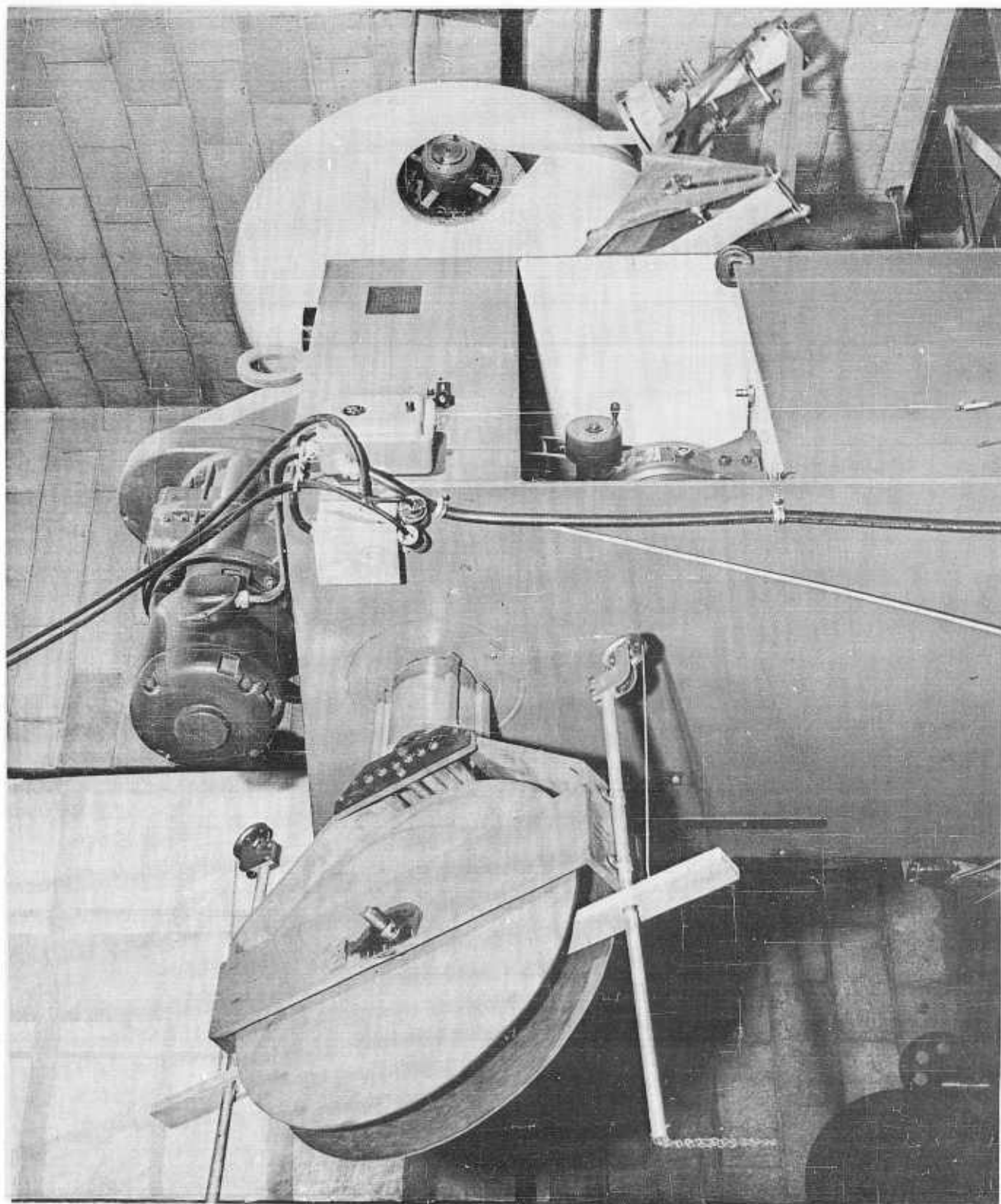


Photo No. 17

NYLON TAPE WRAPPING, GENERAL ARRANGEMENT

This view shows the general arrangement of the winding machine adapted for tape wrapping. Notice that the reel of tape rotates with the axle of the winding arm avoiding twisting (or cabling) during wrapping and that the tension on the tape can be controlled by varying the load on the wooden slat which bears against the tape in the reel. In this view, the first complete layer of overlapping tape is almost wound into place.

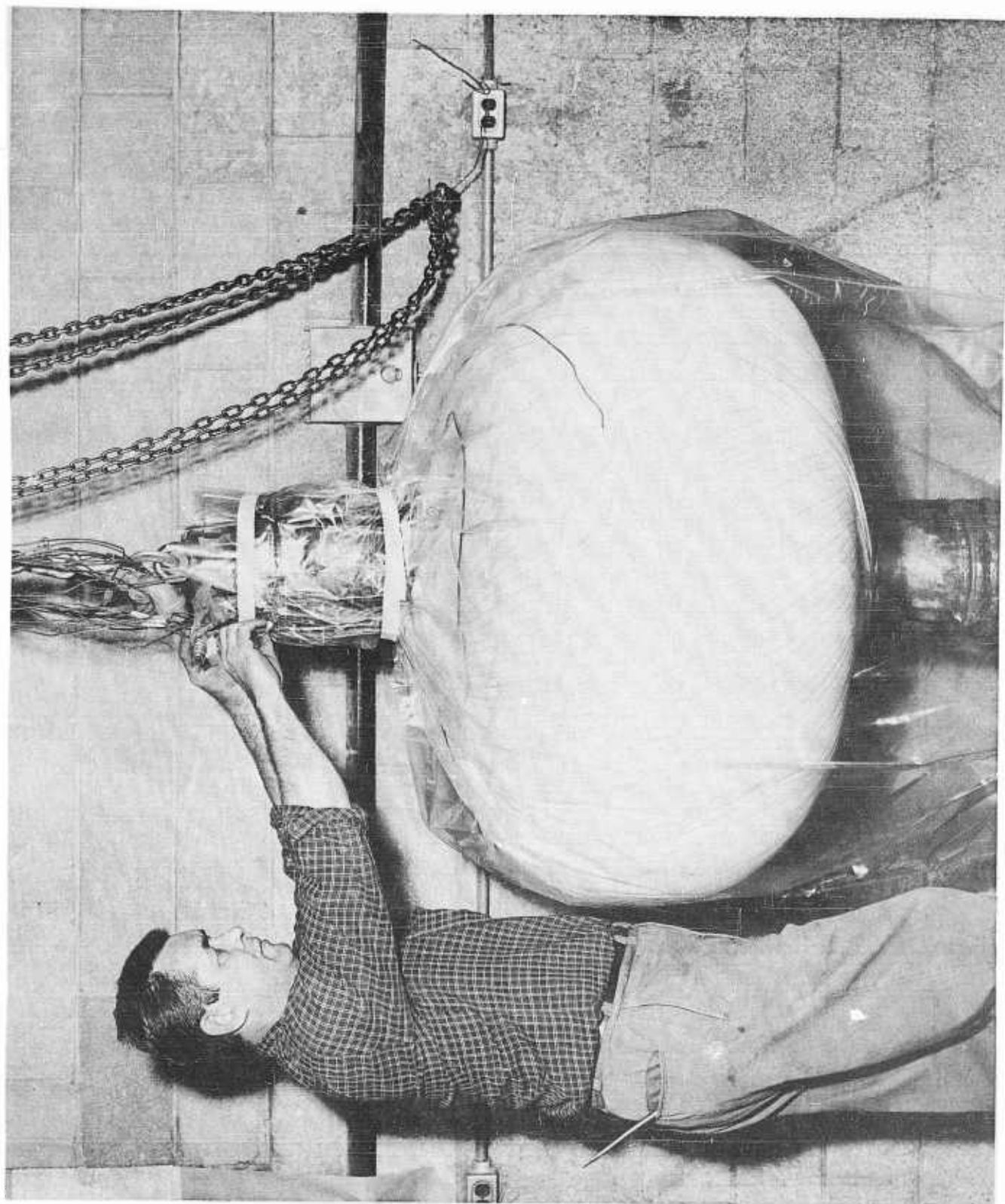


Photo No. 18

PLASTIC FILM PRESSURE BARRIER

After all the curing tape is wrapped into place, the stubby cylinders concentric to each hub are extended by capped cylinders held in place by a spring loaded rod passing through the hollow axle of the mandrel. An open ended sleeve of heat resistant plastic film is shown being sealed about the upper of the two capped cylinders. The bead area of the tire is further compressed during cure by inward movement of the capped cylinders caused by the curing tank pressure. This pressure is augmented by a partial vacuum maintained inside the pressure barrier provided by the plastic film. Maintenance of this vacuum assures pressure on the tire during cure; whereas loss of the vacuum indicates a break in the film and a curing failure unless the break is promptly repaired. Shown also in this view are thermocouple wires placed under the film in order to control curing temperatures.

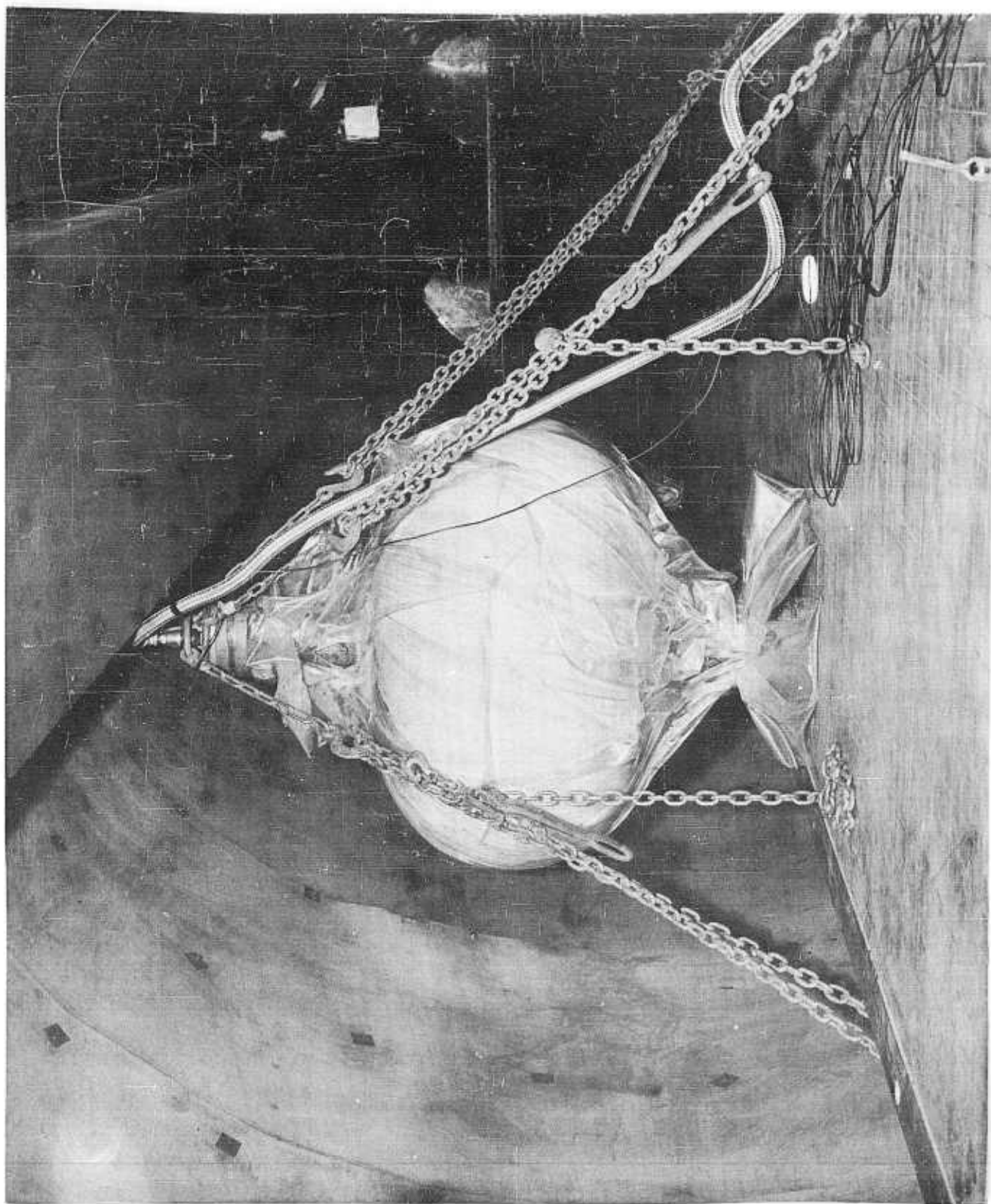


Photo No. 19

CURING

This view shows a 34-inch tire in a curing tank with a partial vacuum on the assembly as indicated by the shrinking of the film against the tape wrapped tire. In later cures the sharp re-entrant angle in axial cross-section between the capped cylinders and the nylon tape near the beads of the tire was faired by filleting with heat-resistant rubber. This reduced the possibility of rupture of the pressure barrier film.

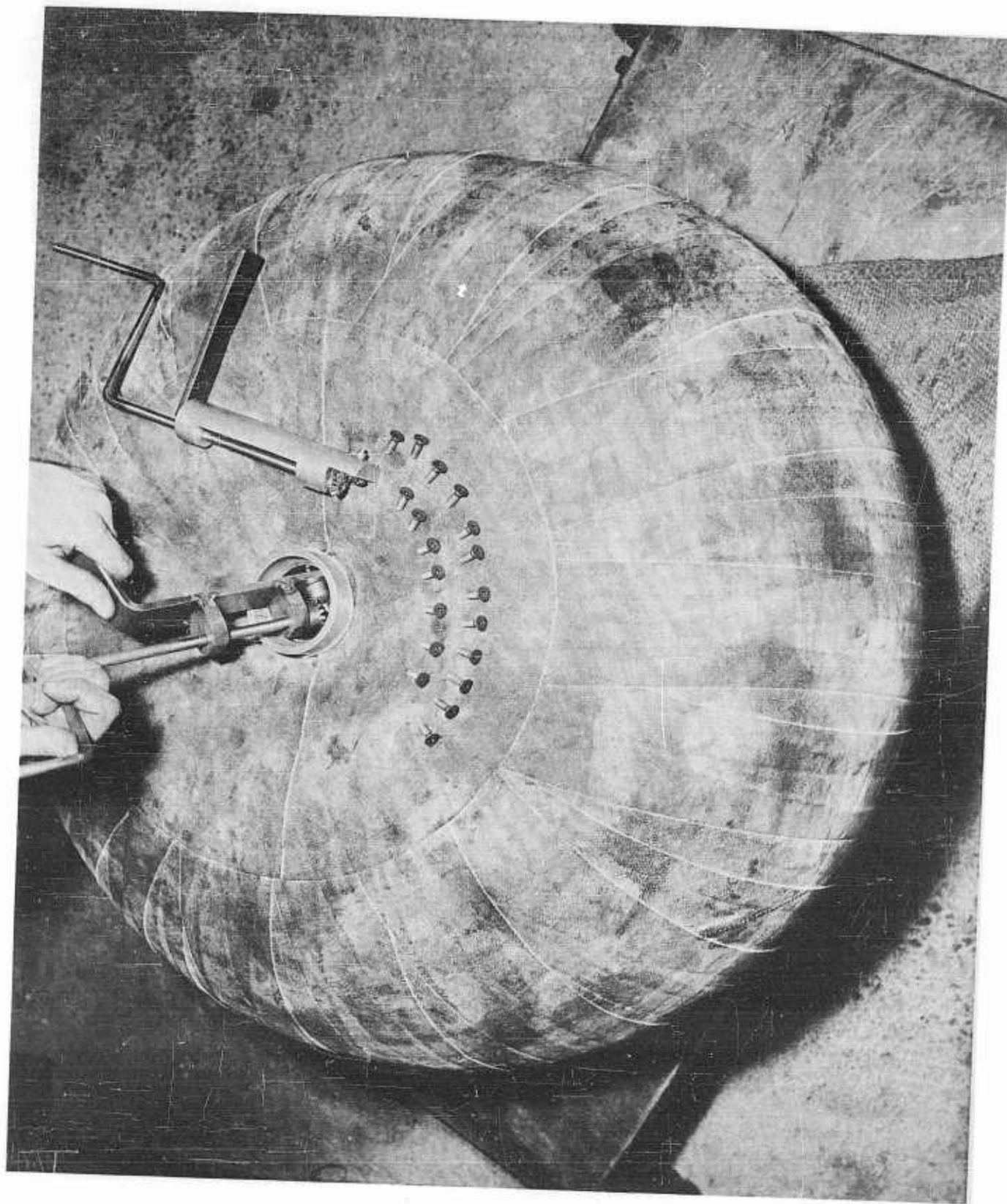


Photo No. 20

REMOVING THE MANDREL

After removal of the plastic film, the thermocouples, the capped cylinders, the nylon tape, the stub cylinders, the copper washers, and the nuts on the hub-flange, bolt-hole-forming rods, a plate is bolted over the central opening of each curing flange. One of these plates has an air hose fitting and the tire is inflated to approximately fifty (50) pounds per square inch pressure through this fitting. This pressure is sufficient to expand the tire and break its partial bond to the mandrel. The curing flanges are now removed and the hub-flange-bolt-hole-forming rods are unscrewed from their tapped holes in the inner mandrel segments. The sleeve which holds the inner mandrel segments in their assembled position is now freed for removal by extracting the flat-head machine screws which pass through the sleeve, radially outward, and screw into tapped holes in each of the inner mandrel segments. The special tool developed for this extraction is shown in use in the photograph. This photograph was taken during a test of disassembly of the 34-inch mandrel and extraction of the segments through the 3-inch hub holes of a simulated tire built by lay up of rubberized fabric. After the sleeve is freed by extraction of the radial screws, it may be removed by sliding it out axially. The keystone segment is then freed by loosening its toggle clamps and extracted. Thereafter, the remaining segments are unclamped and handed out through the opposite hub holes. Small hands are required for disassembly of the 34-inch mandrel with its 3-inch hub hole.

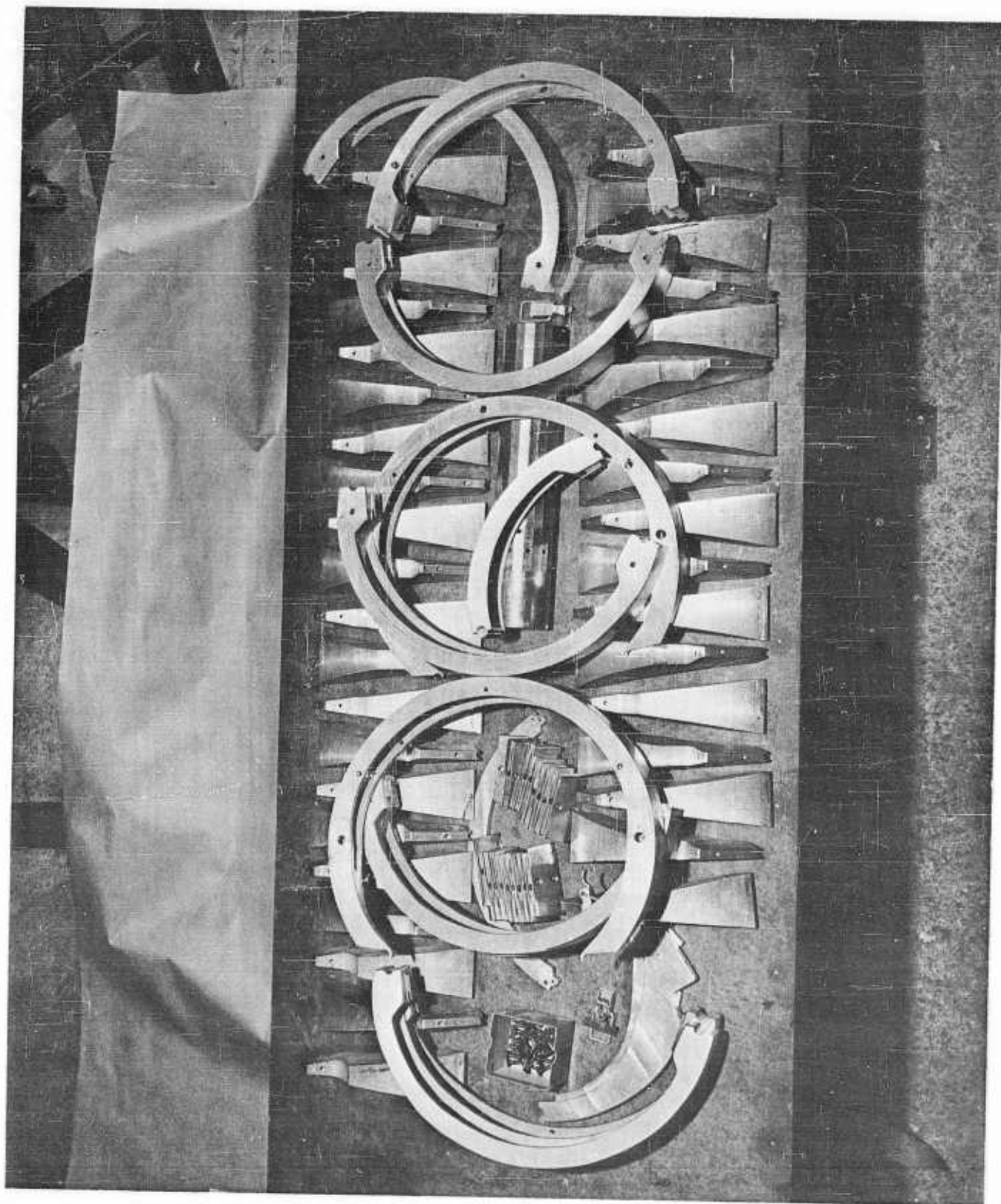


Photo No. 21

MANDREL COMPONENTS

This shows a lay-out of part of the components of the 34-inch mandrel. The axial sleeve is underneath at right center. The inner segments which bolt to the axial sleeve are the tapered pieces on the bottom. The larger pieces on top span across the tread area of the tire between the inner segments. The parallel-sided, keystone segment is shown adjacent to the box of inner-segment screws at the left.

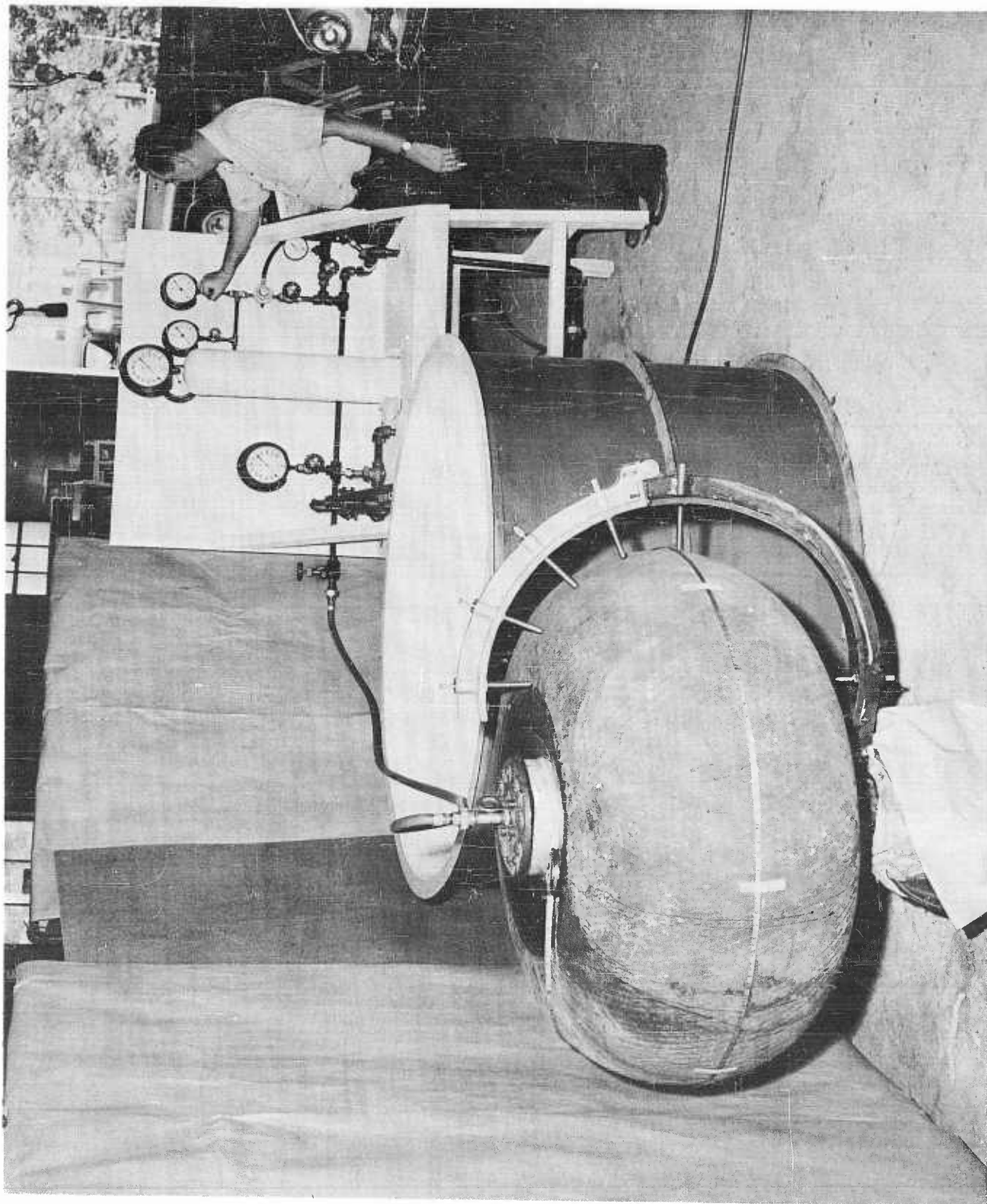


Photo No. 22

PRESSURE TEST APPARATUS

This view shows the developed apparatus for conducting pressure tests. In the background are the gauges, the manually operated water pump, and the receiver tank which provides precise control of water pressure. When testing for the bursting pressure of a tire, it is inflated with water under water, thus eliminating probability of serious accident which might occur if a tire were to explode while inflated with air and also relieving the test tire from carrying the weight of the inclosed water as would be the case if the test tire were inflated with water in air. During burst tests, the tire is first filled with water and pressurized up to the pressure of the service main. The pressure is then gradually increased by alternately pumping up the receiver tank and bleeding it down into the tire, thus avoiding subjecting the test tire to the transient peak pressures developed with each stroke of the pump and permitting an accurate reading of the pressure at the instant of bursting. The gauge for reading water pressure is mounted on the top of the receiver tank. When inflating with air the water system is isolated by closing the valve with inclined stem at the right front edge of the stand. Air is then admitted to the tire through the pressure regulator shown just below the right hand of the technician. Note also the valve just below the regulator which isolates the air gauges when inflating a tire with water. Three air gauges are provided, each with its isolating valve. This arrangement permits a more accurate reading of pressure below 10 pounds per square inch than is possible if only one gauge with reading of 0 to 100 pounds were provided.

In the foreground is shown the apparatus used for measuring the cross-sectional change of shape of test tires with change of inflation pressure. The pointed rods with tips shown bearing against the tire are screwed outward just before each increase in pressure and then, when the desired pressure has been reached and is being maintained constant by the regulator (to overcome any loss by seepage through the temporary seal at the cast aluminum hub), the pointers are screwed into grazing contact and the distance between the tire surface and the rod support bracket is measured by reading calibrations on the rods. The tank in the center is used for submerging the tire while conducting a burst test.

DEVELOPMENT OF PRESENT TECHNIQUES FOR BUILDING TIRES OF CONTINUOUSLY-WOUND CORD

Eight experimental, high-flotation tires were fabricated prior to 1 May 1958, all by the continuous-cord process. The first four were defective in one respect or another and all had many leaks. The last four were considered successful in that they held air, were symmetrical when inflated and had been inflated to a higher pressure than intended in service. Further testing was required, of course, to prove service life and other requisite characteristics.

All eight were wound by the same basic process but with additions to the original machinery and techniques, the equipment being added to after each tire was built in order to solve problems which had caused difficulty with earlier experiments.

The first seven tires were wound of conventional tire cord from cones containing a variable and indeterminate number of knots. These knots were usually in only one strand of the cabled cord and thus, by custom of the industry, the cord was labeled "knotless" by the supplier. After special effort, the supplier eventually was persuaded to use techniques in cord processing which produced cones of truly knotless cord. This cord was used for tire No. 8. The lesson learned was that, when dealing with unfamiliar technical jargon, one must remember that semantic difficulties can occur. Knots in the cord precluded its passage through the rubber extruder, which coated the cord just before placement in the tire carcass, since only a few thousandths of an inch clearance was allowable at the entrance die of the extruder. Up to one and one-half hour delay occurred when a knot was encountered, the delay being the time necessary to cool down the extruder, open up and clean out the cross-head chamber, re-thread the cord through both the entrance and exit bushings, and close and warm up the extruder.

For tires No. 5 through 7, an extruder-threading device was available. This device, specially developed, consisted of a four-foot length of 0.025 music wire with a loop of 0.006" wire soldered to a ground-down section on one end. This four-foot length of wire could be pushed through both dies in the cross-head and then a faired-down cord end could be doubled back through the loop of fine music wire and pulled through the hot rubber. With this method, only five to ten minutes delay was caused by each knot. Such a delay was satisfactory for an experimental technique but was recognized as unsuitable for production. Efforts to secure truly knotless cord were continued with eventual success, as reported above.

For tires 1 through 3, erratic rubber coating by the extruder was encountered. This difficulty had not been anticipated and it caused much trouble. Eventually, two steps were found necessary and adequate to correct the condition. First, a heating cabinet was provided between the supply cone and the rubber extruder. This step was suggested because it was known that the rubber would adhere to hot cord more readily than to cold. The other step consisted of providing supplementary spillway ports for the rubber, concentric to the exit bushing of the extruder. This step was suggested after observation of partial cure of the rubber in the extruder when it had been opened for cleanout during re-threading occasioned by knots.

Another unanticipated problem was caused by the force of 8 to 10 pounds needed to pull the cord through the extruder. The resulting tension in the cord at the winding arm caused the cord to slide along the surface of the partially wound tire, in the region of the shoulders. This sliding resulted in a bunching and generally non-symmetric cord array which became increasingly severe as more and more turns of cord were wound into place. The low shear strength of the green, uncured rubber was not sufficient to hold the cord where wound. Several steps were taken to correct this condition and related problems. The first was to provide a servo-controlled, powered capstan and "festooner" (or temporary cord-holding device) between the rubber extruder and the winding machine. This unit reduced the tension in the cord at the mandrel to a pound or so and provided synchronization between winding machine and capstan. It produced a decided improvement, but not good enough, because even at this tension the cord had a tendency to slip on the shoulders of the mandrel and produce a non-symmetric pattern.

At about this time a related problem was appreciated. The surface of the mandrel, upon which the cord is wound, is not circular in the winding plane. As a result, a cyclic variation in the speed of the cord through the fair leads at the end of the winding arm is caused. This variation in speed produced a jiggling of the lower, or floating gang pulley of the festooner at all winding speeds except dead slow. Eventually this jiggling would cause the cord to become unreeved from one or more pulleys, with a consequent jamming and probable breakage. Winding would have to be stopped and the cord re-reeved. The cure was the provision of a tensioning device consisting of a horizontally sliding pulley held by a spring of several feet of thin rubber ribbon (salvaged from a golf ball initially). In addition, all pulleys between this spring-tensioner device and the fair leads at the end of the winding arm were replaced by very light weight ones of aluminum.

While experimenting with the tensioning devices and light-weight pulleys discussed above, it was found that more symmetrical winding could be secured if a thin sheet of carcass stock rubber were placed on the partially wound tire in order to provide a winding surface tacky enough to hold the cord in place. Several successful tires were built with these supplementary sheets of rubber, but this technique was abandoned when it was learned that erratic cord coating was being caused by foreign material in the carcass stock being fed to the extruder. When consistently good cord coating was secured with clean extruder stock and when the final tensioning device was in operation, it was found that symmetrical winding could be attained without applying the extra sheets of rubber.

It had been planned originally to provide pressure for the cure of the first few dozen tires by wrapping them with nylon tape, utilizing the shrinkage of nylon at rubber curing temperatures to provide the required curing pressure. Tires 1 through 4 had a good cure from one shoulder across the tread area to the other shoulder. As might perhaps have been expected from considerations of angle and normal force, the cure was poor in the sidewall portion of the tires between the shoulder and the metal curing flange bolted to the hubs and concentric thereto. For tires 3 and 4, an attempt was made to increase the pressure in the areas between the shoulders and the hubs by placing a small aircraft tire inner tube concentric to the hubs on each side and under the last half of the turns of curing tape and inflating these tubes before placing the wrapped tire in the curing autoclave. These attempts were failures, probably because the inner tubes failed by blowout sometime during the curing cycle. Adequate pressure concentric to the hubs was achieved in tires 5 through 8 by covering the whole assembly with a sleeve of either polyvinyl alcohol or polyvinyl fluoride and sealing this sleeve at each end to a capped metal tube, caps outward, held concentric to the axis of the tire. This arrangement provided adequate pressure for good cure throughout the whole tire carcass for these last four tires and assurance of continuous pressure was attained by keeping a vacuum on the inside of the tire during the curing cycle.

Another problem incident to tire winding was recognized. There is considerable build-up of tire cord around the hub, the amount varying with the relative velocities of rotation of the winding arms and mandrel and with the angle between the two axes of rotation. During experimental tire building to date, this build-up has been corrected by varying the angle slightly between the axes of rotation, during the winding of a tire. Admittedly this solution is only temporary measure because any change in this angle results in a change in the cross-over angle at the centerline of the tread, and consequently causes a change in the structural properties of the tire. This is a problem which needs more study.

It is expected that the proper angle between the two axes will be found only after a number of tires have been wound, with the same relative velocities of rotation but with the angle varied, and the results have been studied.

Related to the problem cited above is another one brought about by the geometry of the situation. The set-out position of the hubs on the winding spindle is that point which causes the length of cord from tangency on the mandrel to tangency at the hub to be equal to the same length along the surface of the mandrel when the hub has been moved into its recess in the mandrel after completion of winding. As the winding progresses, the build-up of cord at the hub disturbs these critical relationships. In tires wound to date, this difficulty has been corrected by an arbitrary set-in of the hubs at intervals during winding, in an attempt to have all the cords in the completely wound tire at the same tension. This problem also needs an experimental solution.

In the early planning stages of the overall program, it was recognized that a successfully wound tire would require a rigid mandrel. The tires built to date have been wound upon a segmented mandrel of cast aluminum, all parts of which will pass through a 3-inch hub opening for the 34-inch tire and through a 5-inch opening for the 43-inch tire. These mandrels require several man-hours for assembly and several more for disassembly after a tire has been cured upon them. Despite the use of mold-release compounds on the mandrels, all tires to date have had a tendency to stick to the mandrels. It has been learned that inflation of the tire prior to removal of the mandrel will cause separation of the tire carcass from the mandrel segments and permit relatively easy removal of the segments through the hubs. This inflation saves a few man-hours, but use of the segmented metal mandrel is recognized as satisfactory only during the development phase. Even with inflation of the tire prior to the disassembly of the mandrel, its use is too time consuming for a production process. Development must be continued on this part of the process.

The machine built for experimental tire winding has several features not required in a production machine. For instance, there is almost complete flexibility in relative speeds of rotation of mandrel and winding arm, and the angle between the axis of rotation of the two can be varied at will from 0° through 90° . Thus the machine can wind any cord pattern possible to achieve with a continuous cord process on a torroidal mandrel. A simpler machine with less flexibility would be more appropriate for production. Fixed gear ratios, rather than variable-speed drives, would be one advantageous feature possible in a production machine. Before fixed gear ratios can be specified, however, the optimum cord pattern must be determined with more certainty than

at present. It is the present belief that optimum gear ratios will be known only after extensive service testing of high-flotation tires.

The high-flotation tires built to date have been fabricated of conventional tire cord and natural rubber. Because of slippage in the shoulder region of the tires during winding, there is reason to believe that winding a ribbon of several, perhaps even as many as fifty, parallel cords each of very small diameter might result in a more accurate, consistent and controllable placement of the tension-carrying material in the tire carcass; in addition, using the method may produce a lighter, more flexible tire because of reduction of percentage of rubber by weight. Resolution of these points will require extensive experimentation because the critical factors are not known and thus this problem will not respond to analysis.

Some of the recent developments in synthetic rubbers, particularly neoprene and urethane rubbers, offer promise of greater utility in high-flotation tires than natural rubber. In particular, properties such as improved abrasion resistance and indifference to attack by ozone or hydrocarbons are very promising in the urethane rubbers. Considerable experimentation will be required before urethane rubbers or other rubber-like materials can be exploited.

Winding a high-flotation tire of one continuous cord is time consuming, at best. The present experimental winding machine has separate spindles for the mandrel and winding arm, thus limiting winding to one cord. If both rotational motions were achieved with one vertical axis, it would be possible to feed in any reasonable number of cords (or ribbons of parallel cords) simultaneously in a horizontal winding plane, thus reducing the time of winding a tire by a marked degree. It is believed that production winding machines should be based upon the principle of simultaneous winding of a number of cords (or ribbons of cords).

RECAPITULATION - PROBLEM AREAS

The remaining unsolved problems suggested by the above are presented again in the form of research and development objectives as follows:

1. Detailed design and construction of a high-flotation tire winding machine capable of simultaneous winding of more than one cord or ribbon of continuous cord; such a machine should have sufficient flexibility to permit winding of all cord patterns practical for any torus-shaped high-flotation tire but not necessarily capable of an infinite variation of cord-crossing angle at the centerline of the tread; the machine should be capable of winding tires of a maximum diameter of about seven feet. Adjustment of the angle between the axis of the mandrel and major axis of rotation and adjustment of position of hubs on mandrel axis shall be possible during high-flotation tire winding without cessation of winding.
2. The investigation of all tension-carrying and impregnating materials suitable for use in building high-flotation tires with particular emphasis on feasibility, light weight, abrasion resistance, immunity to attack by atmospheric oxygen and other chemical agents likely to be encountered in service, and retention of desirable properties at both low and high temperatures. This work should begin with reconnaissance of available fibers and rubber-like materials and progress through laboratory development of processes and auxiliary apparatus needed for use by high-flotation tire winding machines. In particular, possibilities of ribbon-shaped tension carrying materials should be fully explored.
3. Conduct such analytical and experimental work as is required to determine optimum shape and cord pattern for high-flotation tires as regards supported load versus foot print area and shape, ability to roll over obstacles, and maximum deflection to decelerate the sinking speed of a landing aircraft, all toward the end of minimum weight consistent with adequate performance and service life. This work should begin with an analytical reconnaissance of available shapes including cross-sections both of intersecting and non-intersecting circles, and the production of a test lot (approximately 8) of high-flotation

tires of a cross-section of intersecting circles of at least four cord patterns. Later phases should include exploration of other possible shapes and cord patterns and will utilize the mandrels developed by the work in that problem area. Basic tire behavior data should be gathered by the existing rolling test rig. Service life and performance of these experimental high-flotation tires will be determined by the tests performed under the subject service tests.

4. Investigate all available inflatable, fusible, dissolvable, or friable materials or combinations thereof which may be adapted to use as mandrels for high-flotation tire winding with the overall objective of reduction of man-hours and costs in the production of high-flotation tires. This work should begin with reconnaissance and small-scale laboratory experimentation. Later phases should include full scale experimentation and adaptation of the most promising materials to experimental high-flotation tire building.

5. Design and produce clam-shell-type, female, tire curing molds for all sizes of high-flotation tires. These molds should incorporate provisions for changing the tread pattern and for obtaining optimum pressure and temperature during curing cycles. Emphasis should be on sound tires and simplicity of equipment with complete control of the process rather than upon automation.

6. Determine relative merits of new high-flotation tire materials and configurations by service life tests conducted by ground vehicles. Initially, several designs of the 34-inch size should be tested to develop information on:

- a. the ability to encompass obstacles,
 - b. the ability to transmit driving and braking torque,
 - c. heat produced while rolling,
 - d. fatigue failure of tire carcass due to severe flexing,
- and e. abrasion and penetration resistance.

Appendix A

These tests under simulated service conditions will supplement but not duplicate the static and rolling tests conducted to determine optimum high-flotation tire configurations.

CONTINUOUSLY-WOUND-CORD TIRE DESIGN

A torroidal-shaped, inflated structure with a central hole small in relation to the overall diameter has a wide variation in the tensile stress pattern throughout the structure, especially if the pattern is interrupted by restraint as at the bead area of a tire. If the structure is stressed only by the inflation pressure and restraint at the bead, the stress pattern is essentially symmetrical about the major axis of symmetry and on each side of the plane of the centerline of the tread, but the intensity of the maximum stress varies greatly from the centerline of the tread toward the bead. For an inflated but unloaded tire of small bead diameter relative to the overall diameter and which inflates to essentially circular cross sections on both sides of the major axis, there is much evidence pointing toward maximum and minimum stress in the ratio of three to two at the centerline of the tread. At any point on this centerline, the minimum stress lies in the plane of the centerline of the tread (circumferential) and the maximum stress (radial) is perpendicular to it lying in a plane which contains the major axis. Moving toward the bead in a plane containing the major axis, the circumferential stress, which is perpendicular to the plane of the section, remains about constant but the radial stress increases. A perfectly balanced tire design should take account of this variation in the stress pattern and place the tension-carrying material in the density and direction which achieves equal stressing throughout the structure. Such ideal conditions are, of course, impossible to achieve with restraint at the bead, but a minimum weight structure will be the closest practical approximation. Placement of the tension carrying materials, the cords, in a properly-designed, continuously-wound tire can achieve this approximation to a remarkable degree.

Analytical determination of the stress at any particular point on a continuous-cord tire is very difficult, probably impossible at reasonable cost, when the structure is inflated and deformed by loading through the bead as is normal for tires when in use. Therefore, empirical methods have been used in the past for design of conventional tires and probably should be used for continuously-wound-cord tires. The development of the experience data upon which empirical design should be based will require the fabrication and testing (under service conditions) of a large number of tires because there are a number of variables which should be explored. Cord size, tire cross-section shape, quantity, type and placement of impregnating rubber, the shape of the curved portions of the cord paths in the tread area of the tire, and tread requirements are probably the most important of these variables. These factors are probably interrelated but the relationships are not known since experience gained with conventional tires is not directly applicable in most cases.

At the centerline of the tread, symmetry permits approximate analysis of the stress pattern for the inflated but unloaded tire. Let us assume the cross-section through the major axis is represented by two tangent circles. Let the radius of the centerline of the tread be R . Then the radius of the shoulder of the tire (the widest portion) about the major axis is $\frac{R}{2}$. For a given inflation pressure Δp , the total

load across the centerline of the tread imposed by this pressure equals $\Delta p \pi R^2$ minus $\Delta p \pi \left(\frac{R}{2}\right)^2$. The circumference equals $2 \pi R$. Dividing the

total load by the distance along which it is applied, we get the load per unit length, the stress. This reduces to $\frac{3}{8} \Delta p R$. It is the maximum stress (radial) at any point on the centerline of the tread for the inflated but unloaded tire.

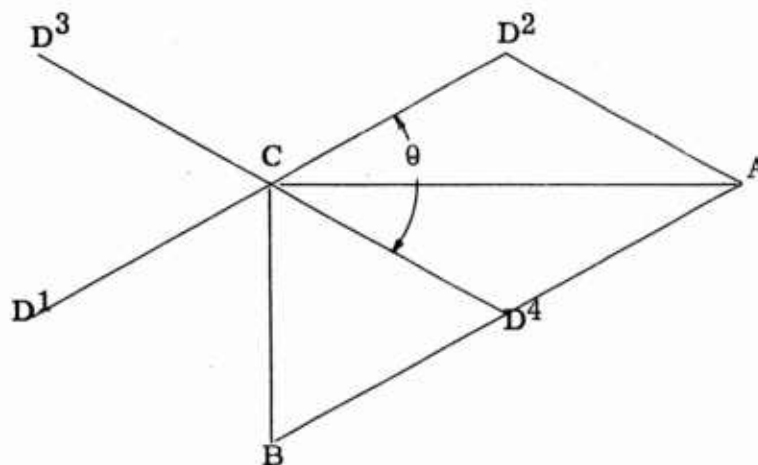
The minimum stress (circumferential) at all points on the centerline of the tread is perpendicular to the planes passing through the major axis. The total load on any sections taken through the major axis resulting from the inflation pressure Δp is equal to $\frac{\Delta p \pi R^2}{2}$. The

distance along which this load is applied equals $2 \pi R$. Therefore the stress or load per unit length equals $\frac{\Delta p R}{4}$. (This analysis is not

so rigorous as the analysis of the radial stress because symmetry does not necessarily require a uniform loading along the cross-section).

Assuming that the circumferential tension does equal $\frac{\Delta p R}{4}$,

let us now determine the cord-crossing angle at the centerline of the tread which will produce a balanced design.



In the foregoing diagram let the line C B represent a portion of the centerline of the tread. Let D¹ - D² and D³ D⁴ represent two cords which cross at C. Let the angle D² C D⁴ be known as the cord crossing angle Θ . Let T = tension in any one cord at C.

$$\text{Then } 2 T \cos \frac{\Theta}{2} = \text{Stress in direction C A (radial)}$$

$$\text{and } 2 T \sin \frac{\Theta}{2} = \text{Stress in direction C B (circumferential)}$$

If Radial Stress at C = three halves the circumferential stress at the same point,

$$\text{then: } \cos \frac{\Theta}{2} = \frac{3}{2} \sin \frac{\Theta}{2}$$

$$\tan \frac{\Theta}{2} = 0.667$$

$$\frac{\Theta}{2} = 33.7^\circ$$

$$\Theta = 67^\circ \text{ (approximately)}$$

It may be concluded that a cord-crossing angle, as defined above, of approximately 67° would provide the optimum stress pattern for the inflated but unloaded tire at the centerline of the tread. This means that along the centerline of the tread the inflated but unloaded tire carcass is strained to the same degree in all directions so long as the cross-section is essentially circular. Thus the forces tending to separate the cord from the impregnating rubber are minimized and it is probably safe to conclude also that the heat generated by change of stress intensity as the tire rolls along is also minimized. In other words, optimum design is achieved at the centerline of the tread when the cross-over angle at this point is about 67° for an inflated but unloaded tire which inflates to a circular cross section. Since such a tire in service is essentially circular in cross section every place except in the areas in contact with or near the ground, this is probably very close to the optimum cross-over angle for the center line of the tread for a tire in service despite the disturbance to the stress pattern brought about by the restraint at the bead and the deformation caused by contact with the ground.

Because of the uncertainty of the theoretical distribution of the circumferential stress between the centerline of the tread and the

bead, with the inflated but unloaded tire, the foregoing analysis was not deemed adequate for the design of the tires to be used in flight tests of the venting-hub rough field landing gear system. Since available funding permitted the building and testing of only a very limited number of tires, it was decided to check this theory by building tires of three different designs and determine their inflated shape by direct measurements. It was considered that the design which inflated most nearly to circular cross sections and which would change shape most nearly symmetrically with increasing inflation pressure, would be selected as the most nearly balanced design and subjected to further tests for load-carrying ability, etc. before being mounted on the flying test-bed aircraft. Accordingly, tires with cross-over angles of 90° , 60° , and a combination of one-half 90° and one-half 60° were built. This latter design was selected as being equivalent to a design with a cross-over angle of 75° with the further possible advantage of checking the affect, if any, of multiple cord directions, this latter being a moot question.

The three tires were then inflated to pressures of 5, 15, 30, 40 and 50 pounds per square inch and the cross-section shape measured and plotted full scale for each inflation pressure. The 90° cross-over angle design appeared to "grow" more rapidly between the shoulders than in overall diameter as if the tire had more restraint than necessary to stress in the circumferential direction at the centerline of the tread. The 60° tire appeared to "grow" with increasing inflation pressure slightly more in overall diameter than in width, but in general the inflated shape was more nearly circular than either of the other tire designs. The combination design appeared to "grow" more in width than in diameter, similarly to the 90° design but to less extent. The 60° design was selected for further testing because this design most nearly met the test objectives and because this design has less "wrap-around" of the hub and thus a tire built to it would have slightly less weight than for either of the others. In addition, the slight departure from a circular cross-section exhibited by the 60° design in favor of slightly increased overall diameter appeared to be advantageous in that it provided a small amount of additional deflection, (or increased rolling radius) in the tire.

In view of the limited scope of these inflation tests, it is not believed that any conclusions should be drawn concerning the validity of the assumption that the maximum stress is 150% of the minimum stress at the centerline of the tread. The most that can be said with confidence is that the results of these tests are consistent with this assumption.

A continuous-cord tire designed with cross-over angle of about 67° would, of course, not necessarily have the optimum cord pattern except at the centerline of the tread, because the bead diameter and the clearance of fair leads at the end of the winding arm as it crosses the plane of the centerline of the tread both affect the pattern of the cords over the tread area of the tire between the centerline and the point where the cord leaves or touches the surface of the mandrel during winding. Of these two variables, the bead diameter is usually established by considerations of axle size or vent port area requirements so that only the clearance of the winding-arm fair lead remains as a factor which may be varied in a program of empirical determination of optimum design, so long as the mandrel cross-section is based on two tangent circles.

The basic cross-sectional shape of the tire may also be varied, of course. If this cross-section is based on two intersecting circles, less distortion in the shape is needed to cause the carcass to conform to the ground when in contact; thus there may be less disturbance to the stress pattern in the portions of the tire not in contact with the ground. If this is true, this shape should have less reversal or change in stress while rolling and consequently less production of heat with a resulting increase in service life.

If the optimum cord-crossing angles, between the centerline of the tread and the circle where the cord leaves or returns to the surface of the mandrel during winding, cannot be attained with mandrels based on circular cross-sections, there are possibilities that elliptical or spiral cross-sections may achieve the desired results. Tires wound on such mandrels should probably be cured to a circular cross-section to avoid residual stress in the impregnating rubber, and thus experiments with non-circular mandrels should be conducted only after techniques of curing in conventional female molds are worked out.

There remains possibilities of restraining the contour of the tire in a manner which causes the inflated cross-section to become an approximation of a cylinder with segments of circles connecting the ends of the cylinder to the hubs. This cross-section can be wound by the same method employed for tires of intersecting or tangent circle cross-sections and in addition may have the advantage of even less disturbance of stress pattern for a loaded, rolling tire than is the case for the cross-section of intersecting circles. If this is true, and only empirical methods can determine its validity, minimum weight and maximum service life may be possessed by this design. The central portions of the tread area of such a tire would be reinforced with cords wound parallel to the plane of the centerline of the tread. These reinforcing cords would serve to restrain the inflated contour of the tread area of the tire to the desired cylindrical shape.

Minimum weight will be achieved with minimum but adequate tread. The restrained contour design may be the basic design which promotes minimum weight because the weight of the cord necessary to restrain the contour is a small percentage of the total weight of cord needed for a tire and this design may minimize tread wear (and required tread thickness) by reducing scrubbing of the rolling tire on the ground.

As regards cord, minimum diameter cord means minimum impregnating rubber, minimum tire weight and minimum thickness. Practical considerations set the minimum cord diameter if single cords are wound, but if a ribbon of parallel cords is wound, each cord may be very small in diameter without occasioning an unpractically large number of total winding turns in a tire. In addition, the flat surface of a ribbon will promote adhesion of the ribbon to the turns previously wound and reduce drift of the ribbon sideways along the shoulder of the tire during winding thus permitting greater tension in the ribbon than in a single cord. Ribbons may be wound from a spool or reel which rotates with the winding arm axle without cabling the ribbon. It should be noted also that if the winding machine is arranged so that the mandrel axle rotates about an axis passing through the center of symmetry of the mandrel and perpendicular to the winding plane, a number of ribbons (or cords) may be wound in a horizontal winding plane, simultaneously, without cabling. It is believed that production winding machines should be based on this latter concept.

For continuous-cord tires which do not require folding, it is possible that steel wire may be a more useful "cord" material than nylon or other more conventional fibers. Since there is no problem of end anchorage in the continuous-cord method, and since steel wire possesses greater tensile strength for a given diameter, thus reducing the quantity of impregnating rubber needed, and since heat is carried away more rapidly by steel than conventional cord material, reducing local build-up of temperature, possibilities of use of steel wire should be explored.

SPECIFICATIONS -

H1 - Flo TIRE

TIRE NUMBER

10

11

12

SIZE

43"

43"

43"

TOTAL TURNS

7750

7700

7700

77

CORD ANGLE

90°

60°

90°

90°

Materials -

Rubber, Inner Carcass Cover, Ga.
(Schenuit = S; Carlisle = C; Gates = G)
Intermediate, Cover, Ga.

S-#5160

S-5160

S-#5160

S-#

.020 1 Pc

.020 1 Pc

.020 1 Pc

.020

S-#9059

S-#9059

S-#9059

S-#

.020 1 Pc

.020 1 Pc

.020 1 Pc

.020

S-#9059

S-#9059

S-#9059

S-#

.020 1 Pc

.020 1 Pc

.020 1 Pc

.020

None

None

None

.020

Outer Cover, Ga. Amount

Ring, Around Hub, Ga. Amount

Tread, Amount, Ga.

Cord Insulation

S #9059

S #9059

S #9059

S #9

Cord, Type (Nylon 420/2)

420/2

420/2

← Cord sticks

Hubs, Type (Inner Rubber Curing Flanges Used
Tin Foil Between Hub and Flange)

Regular

Regular

Regular

Regu

Pre-Heater (Incl. Sheep's Wool Base, Pole for Cone) Temp.

150°

150°

150° to
Room Temp.

150°
Room

De-Kinker, Wt. Units, Heavy Washer (H) = 1.25 oz. Per Pole
(2 Poles per unit), Light Washer (L) = .25 oz. Per Pole

1.25

1.50

1.50

1.50

Slot Bushing (.022" Opening)

.022" ←

Pre-Festooner - Weights (1402 Constant) +
Temperature F°

11

11

11

15

250°

250°

250°

250°

Tuber

Die Space - Male and Female, Inches

3/8

3/16 3/8
5/16

5/16 3/16

5/16

Exit Die, Inches, Type

.035 Al.

.035 Al. & Stl.

.050 Al.

.050

Barrel Temperature, F°

150°

150°

100 - 75°

75°

Head Temperature, F°

200°

200°

200°

200°

Die Temperature, F°

200°

200°

200°

200°

Exhaust Opening (Varies during Run)
Screw Speed (R.P.M.)

3 to 5

5 to 6½

6½

6½

Capstan (2 pulleys - Heat Lamps)

2 Lights

2 Lights
Varied

2 Lights

2 Lig
V ari

Festooner - Counter Wts. oz. (Constant +)
Selsyn Wts. 12 oz. Constant +

12

12

17

17

12

12

20

20

Final Tensioning Device (Approx. 3" Rubber)

Golf Ball

No Good

Model Air- ←



[illegible]

Winding Arm - R.P.M. Average *

Setting From Mark

From Mandrel

Worm Gear Ratio

Speed Variator Setting

Hubs, Bolts - Length

Setting at Start From Mandrel

Amount Turned in @ 1/4, 1/2 & 3/4 Mark

Pulling In Hubs

Type Curing Flanges

Wrapping

Number of Tape Turns

Overlap

Curing

Type - Curing Bag

- Thermocouples

- Vacuum Test

Actual Cure

Average Vacuum

Finished Tire

Description

Weight - Pounds

* Each Turn on 43" = 10' Approx.
Each Turn on 24" = 8' Approx.

Rubber 3 Strands pl

9 to 25 25

42 1/4" 33 11/16" 42

3/8" 3/8" 3

30 - 1 ←

12.6 5.0 12

7 1/4 7 1/4

5 5/8 5 5/8 5

1/8" 1/8" 1/

Manual Hydro-Jack Jac

Schenit Schenit Sch
1 use only 1 use only 1

260 265

50% 50%

R-20 ←
#1
O.K.
Good
#1
O.K.
Bag Broke
Replaced
O.K.
Fe

26 15

O.K. Thin Around S/W. O.K. Thin O.
Never Weighed ←

4

stands	plane 1/8" wide								
	20	25	30	25	25	30	30	30	30
1/16"	42 $\frac{1}{2}$	42 $\frac{1}{2}$ & 33 11/16"	33 11/16"	33 11/16"	33 11/16"	33 11/16 to 34 3/16	34 3/16"	34 3/16"	34 3/16
"	3/8"	3/8"	3 5/8"	3/8"	3/8"	3/8	3/8"	3/8"	3 5/8"
	12.6	12.6 to 5.0	5	5	5 to 5.005	5 to 5.25	5 (-.005)	5.00	5.00
	7"	7"	7"	7" 2 ea Too Long	7 (Pickl'd)	7	7	7	7
8	5 5/8	5 5/8	6"	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	6"
	1/8	1/8"	3/16"	1/8 (100 turns past 3/4 mark)	1/8	1/8"	1/8	1/8	3/16"
o-	Jack	Jack	Manual	Jack	Jack	Jack	Jack	Jack	Jack
mit e only	Schenuit 1 use only	Schenuit 1 use only	Schenuit Used again	Schenuit 1 use only	Schenuit 1 use only	Belko-SAMPLE TOO HARD - TOO SMALL TO FIT →	Belko-Fits PERFECT. CAN BE USED OVER - NEW BUILD-UP (RUBBER STOCK)	Schenuit Use Over	
55	250	260	312	215	212	312	335	280	178
0%	50%	50%	50%	80%	80%	80	80	80	80

	#1 O.K. Fair	#1 O.K. Good	#1 O.K. Good	#1 O.K. Good	#2 O.K. Fair	#1 O.K. Bad @ S/W Due to Flange →	#1 O.K.	#1 O.K. Good	#1 O.K. Good
5	19	22	24	22	23	21	19	19	24
					(Lost During Cure Repaired) Good Tire sent to Battelle				
K. in	O.K. Thin	O.K. S/W Best	O.K.	O.K. Good Tire Used On Test Rig	49.5	N/G	Fair - Leaks air on S/W	O.K. Looks good	O.K. Good
	7 Never Weighed	28 $\frac{1}{2}$		57		Never Weighed ←	47		24.5

5

25 33 11/16" 3/8"	30 33 11/16 to 34 3/16 3/8	30 34 3/16" 3/8"	30 34 3/16" 3/8"	30 34 3/16 3 5/8"	30 34 3/16 3/8"	35 34 3/16" 3 5/8"	30 33 11/16 - 34 3/16 3/8"	30 33 11/16 30 - 1 5.00
5 to 5.005	5 to 5.25 7	5 (-.005) 7	5.00 7	5.00 7	5.00 7	5 - .015 7	5 - .005 2 en. 7 1/2	5.00 7
7 (Pick'd) 5 5/8 1/8	5 5/8 1/8"	5 5/8 1/8	5 5/8 1/8	6" 3/16"	5 5/8 1/8"	6" 3/16"	5 5/8 1/8	6" 3/16" Inner Rubber Curing Flange Jammed 1 Side
Jack	Jack	Jack	Jack	Jack	Jack	Jack	Jack	Jack
Schenuit 1 use only	Belko. SAMPLE TOO HARD - TOO SMALL TO FIT	Belko - Fits PERFECT. CAN BE USED OVER - NEW BUILD-UP (RUBBER STOCK)	Schenuit Use Over	Belko Re-Use. NEW BUILD-UP (RUBBER)	Schenuit Re-Use	Belko Re-Use NEW BUILD-UP (RUBBER)	Schenuit Re-Use	
212 80%	312 80	335 80	280 80	178 80	225 80	211 80	286 80	200 80
#2 O.K. Fair	#1 O.K. Bad @ S/W Due to Flange	#1 O.K.	#1 O.K. Good	#1 O.K. Good	#1 O.K. Good	#2 O.K. Good	#2 O.K. Good	R-20 #2 O.K. Good
23	21	19	19	24	16	24	23	25
(Lost During Cure Repaired) Good Tire sent to Battelle 49.5	N/G	Fair - Leaks air on S/W	O.K. Looks good	O.K. Good	Looks Good	Good	Good	
	Never Weighed	47	24.5	49.5	21.5	43	26.5	

6

REFERENCES

- RR 45 - A Progress Report on the Development of Landing Gear for Use by STOL Aircraft Operating From Rough Unprepared Fields --- Fairchild Aircraft, Division of Fairchild Engine and Airplane Corporation, Hagerstown, Maryland, 1 August 1957.
- R245-004 I - An Analytical Study of High-Flotation Tires for Aircraft --- The Battelle Memorial Institute, Columbus, Ohio. Phase I, 26 October 1956. Phase II, 15 March 1957. Phase III, 1 April 1957.
- Monthly Technical Progress Reports, numbers 1 through 26, beginning with Report No. 1 for the period 21 May through 30 June 1957, for Fairchild Aircraft and Missiles Division, Project M-245B, Contract Number DA 44-176-TC-446, to The Commanding Officer, Transportation Research and Engineering Command, Fort Eustis, Virginia.
- R245-010 - Static Test, High-Flotation Tire, Fairchild Aircraft and Missiles Division, 19 February 1959.
- R245-011 - Rolling Tests, High-Flotation Tire, Fairchild Aircraft and Missiles Division, 17 April 1959.

ENGINEERING REPORT NO.

R245-010

SUBJECT

STATIC TEST

HIGH-FLOTATION TIRE.

MODEL: M245¹B



DIVISION OF
FAIRCHILD ENGINE & AIRPLANE CORPORATION
HAGERSTOWN 10, MARYLAND

Date of Test: 10-21-58 to 12-18-58

Tested by: W. J. Sawyer
W. J. Sawyer

DATE: 19 February 1959

NO. PAGES: 34

PREPARED BY: W. J. Sawyer
W. J. Sawyer

APPROVED BY: J. N. Marsden
J. N. Marsden
Supervisor, Engineering Lab

CHECKED BY: R. R. Enterline
R. R. Enterline

APPROVED BY: R. C. Smith
R. C. Smith
Chief, Technical Engineering

APPROVED: V. Frisby
Project: V. Frisby

REVISIONS

DATE	PAGES AFFECTED	BY	REMARKS

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MODEL M-245	PREPARED BY W.J. Sanger	CHECKED BY H.B. Enterline	APPROVED BY Larson/Saith/Orisby			
SUBJECT:- Static Test - High-Flotation Tire.			DATE 19 February 1959			
			REVISED			

FAIRCHILD AIRCRAFT AND MISSILES DIVISION

Report Number R245-010

Model M-245 B

STATIC TEST - HIGH FLOTATION TIRE

CONTRACT NUMBER DA 44-177-TC-446

"The findings and recommendations contained in this report are those of the Fairchild Aircraft and Missiles Division, and do not necessarily reflect the views of the Chief of Transportation."

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MODEL M-245		PREPARED BY W.J. Sawyer	CHECKED BY R.D. Enterline	APPROVED BY Parsden/Smith/Frisby	
SUBJECT:- Static Test - High Flotation Tire.				DATE 19 February 1959	
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ADMINISTRATIVE DATA

PURPOSE:

As specifically authorized by Contract DA 44-177-TC-446, the purpose of the static testing of a high-flotation tire reported upon herein was as follows:

- (a) Determination of stress distribution by measurement of strain in the tire carcass of one flight test model tire at full range of deflection from the inflated but unloaded tire to the fully bottomed condition in appropriate steps with the initial inflation pressure equivalent to the maximum touchdown pressure in service.
- (b) Determination of footprint area through the full range of deflection.
- (c) Determination of pressure variation through the full range of deflection.
- (d) Determination of supported load versus deflection for the full range of deflection.

In addition a secondary objective was the calibration of the test rig which was subsequently to be used in rolling tests of the same tire.

MANUFACTURER:

Fairchild Aircraft and Missiles Division
Hagerstown, Maryland

MANUFACTURER'S TYPE OR MODEL NO.:

High-Flotation tire #15 rated at 1500# - 43" diameter,
60° cross-over angle of cord-winding.

DRAWINGS, SPECIFICATIONS, EXHIBITS:

Engineering Laboratory Folder No. LTM-187
Wilson, Nuttall, Raimond Drawing No. 41-9
FAMD Drawing No. TM-296

QUANTITY OF ITEMS TESTED:

One

SECURITY CLASSIFICATION:

Unclassified

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SUBJECT:- Static Test - High Flotation Tire.					DATE 19 February 1959	
					REVISED	

ADMINISTRATIVE DATA (continued)

DATE TEST COMPLETED:

18 December 1958

TEST CONDUCTED BY:

W.J. Sawyer, FAMD Engineering Laboratory

DISPOSITION OF SPECIMEN:

Held for use in rolling tests.

ABSTRACT:

Static tests were conducted on a 43" diameter 60° cross-over high flotation tire developed by FAMD under contract DA 44-177-TC-446 with TRECOM. The tire, rated at 1500# was subjected to vertical, side, drag, and torque load tests. Oscillograph records of all test runs were made to calibrate the Wilson-Nuttall-Raimond designed dynamometer.

The vertical load phase of the tests consisted of applying a 6000# load through the axle and tire against a reaction platen at each of the initial tire pressures of 1½, 2, 3, 4, 8, 12, 16, 20, and 24 PSI. Footprint areas with the tire depressed to 6000# vertical load and at initial tire pressures of 4, 8, 12, 16, 20, and 24 PSI were measured and recorded.

Side load tests were accomplished by holding a constant side load on the platen while vertical load at the tire was first increased to 6000# and then reduced until skidding occurred between the platen and the tire. These side load tests were run at 5% increments of a 3200# side load for each of the initial tire pressures of 2, 4, 8, 12, 16, and 20 PSI.

Drag and torque load tests were accomplished in a similar manner to the side load test. Drag load tests were done for initial tire pressures of 4, 8, 12, 16, and 20 PSI. The drag load was applied in steps of 320# with a maximum value of 2880# applied at 20 PSI initial tire pressure. Torque load tests were done for initial tire pressures of 2, 4, 8, 12, 16, and 20 PSI. Torque load was applied to the platen in increments of 4,480 inch pounds with a maximum value of 44,800 inch pounds applied at 4 PSI initial tire pressure.

Oscillograph records were forwarded to Battelle Memorial Institute, Columbus, Ohio for tabulation of the data and plotting of the curves presented in the Appendix of this report.

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SUBJECT:- Static Test - High Flotation Tire.			DATE _____		
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FACTUAL DATA

DESCRIPTION OF TEST APPARATUS:

The test apparatus used in the static test of the high-flotation tire consisted of a heavy steel truck trailer type rig designed by Wilson, Nuttall, and Raimond and manufactured by Thompson Equipment Machine Co. The rig was supported at its front end by a steel tube stand and at the rear by two calibrated load cells which were mounted on a series of steel support beams. The test set-up is illustrated in photograph no. 38382 in the Appendix.

The rig consisted of an open rectangular base mounted on truck wheels, for use in rolling tests, located at the rear of the base, and a raised platform at the front or tow end suitable for mounting equipment for rolling tests. A large U- shaped yoke was mounted vertically on the longitudinal center line of the trailer which supported an air cylinder, rated at 750 PSI. This jack was used for applying vertical load. The test specimen, a 43" diameter 60° cross-over High-Flotation tire, was mounted on a rotating axle and brake assembly which had for its supporting strut a 6-component dynamometer designed by Wilson, Nuttall, Raimond, This dynamometer and tire axle acting as a strut assembly were mounted in the yoke so that the jack could apply vertical loads to the tire.

The dynamometer was of such design that all extraneous loads felt by the strut under a given loading condition would be cancelled out, and the dynamometer reading recorded for each of the 6 components would be only the loads or moments existing at the center-line of the test tire.

The wooden loading platen under the tire was supported on steel balls rolling between ground steel plates to allow free movement in the horizontal plane. Jacks mounted on the steel beams supporting the rig were attached to sides of the platen so that side, drag, and torque loads could be applied to the platen independently with the tire depressed under the vertical load. Sandpaper was glued to the platen surface to provide a high friction surface for the side, drag, and torque tests.

Tire radius and tire width changes were measured by standard laboratory deflection pick-ups (Ref. drawings TM280 and TM281). Vertical deflections were measured by helipots (Ref. drawing TM-315). Standard deflection pick-ups were mounted on the jig base and connected to the platen, for side, drag and torque tests, to measure movement of the platen under these loads. All of the deflection measuring devices, the 6 channel dynamometer, the 2 vertical load cells and hydraulic jack load cells when used, were recorded on a C.E.C. Oscillograph.

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FACTUAL DATA (continued)

DESCRIPTION OF TEST APPARATUS: (continued)

Stress distribution by measurement of strain in the tire carcass was not accomplished as no satisfactory method of measuring strain over a short gage length could be determined.

The vertical jack, the dynamometer and strut assembly, tire reaction platen, and deflection measuring devices are shown in photographs 38383 and 38384, and detailed in drawings TM-296 (FAMD) and Wilson, Nuttall, Raimond drawing No. 41-9.

TEST PROCEDURE:

VERTICAL LOAD TEST.

At an initial tire pressure of 4 PSI, a vertical load of 6000# was slowly applied to the tire by depressing it against the platen, and then the load was slowly removed. An oscillograph record of the load cells and dynamometer during the load application and removal was made. A pip was recorded on the oscillograph at the time at which the tire began to wrinkle under load. This procedure was repeated at 8, 12, 16, 20, 24, 3, 2, and 1½ PSI initial tire pressures. Following this test, stamp pad ink was brushed onto the tire surface and a large piece of paper was placed on the platen. A 6000# vertical load was applied depressing the tire onto the paper. Tire footprints were made in this manner at initial tire pressures of 4, 8, 12, 16, 20 and 24 PSI and 6000# vertical load. The footprint areas were measured and are presented in the data section of the appendix. A plot of vertical deflection vs vertical load for each initial tire pressure was plotted from data obtained in this phase of the test as well as a calibration curve for dynamometer vertical load.

SIDE LOAD TEST.

Side load tests were conducted by applying a sufficient vertical load to hold the platen steady while a side load was applied by separate hydraulic jacks. Holding this side load constant, the vertical load was increased to 6000# and slowly reduced until the platen skidded from under the tire. Using this procedure, oscillograph records were taken in 5% increments of a 3200# side load at 2, 4, 8, 12, 16 and 20 PSI. The point at which the skid occurred was observed visually and recorded as a blip on the oscillograph. A plot of vertical deflection vs. vertical load for each increment of side load was plotted from data obtained. Separate curves were plotted in this manner for each initial tire pressure. A calibration curve for the dynamometer side load was also plotted.

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FACTUAL DATA (continued)

TEST PROCEDURE: (continued)

DRAG LOAD TESTS.

Drag load tests were done in the same manner as the side load except braking action of the tire was required for this test. This necessitated the use of a locking plate to restrain the tire from rotating when the brake installed for that purpose failed to hold. Similar curves were also plotted.

TORQUE LOAD TESTS.

Torque load tests were conducted in a like manner to those above and curves of the same type were plotted.

Comparison curves of vertical load vs side load and vertical load vs drag load at skid point were also plotted and appear in the Appendix.

RESULTS OF TEST:

The dynamometer readings were found to be consistent for given loads and the high flotation tire withstood all loading phases of the test with no measureable permanent distortion. Some wearing of the tire's surface occurred as a result of the frictional pull and twist encountered in the side, drag, and torque load phases of the test. The lack of tread-stock on this test tire is responsible for this result.

Vertical load test curves of vertical load versus vertical deflection at varying initial tire pressures indicate wrinkling of the tire at $1\frac{1}{2}$ PSI under a load as small as 750#, and very small or no wrinkling at all at 16, 20, and 24 PSI under full 6000# load.

Curves plotted from side, drag, and torque load test data show a 1.51 ratio of vertical load to side load at skid, a 1.45 ratio of vertical load to drag load at skid, and .117 pounds of vertical load per inch pound of torque at skid. Curves of vertical deflection versus vertical load plotted for side, drag, and torque loads show only a small variation of vertical deflection resulting from high and low, side, drag or torque loads. The maximum vertical deflection variation being approximately 2 inches for drag loads under 6000# vertical load and 4 PSI initial tire pressure. The general trend was for maximum variation of deflection at low initial tire pressures and then diminishing with increased tire pressures.

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FACTUAL DATA (continued)

RESULTS OF TEST:(continued)

Pressure variation under 6000# vertical load ranges from almost double the initial tire pressure at 4 PSI to a negligible change at 24 PSI.

TEST DATA:

Submitted in the Appendix.

CONCLUSIONS:

The test specimen withstood a maximum of 6000# vertical load, a maximum of 2880# side load in combination with a 6000# vertical load, a maximum drag load of 2880# in combination with a 6000# vertical load, and a maximum torque of 44,800" in combination with a 6000# vertical load. The test tire showed no signs of undue stress under repeated loading combinations at varying initial tire pressures. It is thus concluded that the test tire has load carrying capabilities well in excess of its design values.

RECOMMENDATIONS:

It is recommended that the tire be subjected to a Rolling Test program to determine dynamic stability prior to flight tests. In the opinion of the FAMD Engineering Laboratory, the tire should prove completely satisfactory for flight testing.

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<p><u>APPENDIX</u></p> <p><u>CONTENTS OF APPENDIX</u></p> <table> <thead> <tr> <th><u>ITEM</u></th> <th><u>PAGE</u></th> </tr> </thead> <tbody> <tr> <td>List of Photographs</td> <td>8</td> </tr> <tr> <td>Log of Test</td> <td>8</td> </tr> <tr> <td>Footprint Area Data Sheet</td> <td>9</td> </tr> <tr> <td>Graphical Data</td> <td>10 thru 34</td> </tr> <tr> <td>Photographs</td> <td>Appended</td> </tr> </tbody> </table>						<u>ITEM</u>	<u>PAGE</u>	List of Photographs	8	Log of Test	8	Footprint Area Data Sheet	9	Graphical Data	10 thru 34	Photographs	Appended
<u>ITEM</u>	<u>PAGE</u>																
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APPENDIX

LIST OF PHOTOGRAPHS:

<u>Number</u>	<u>Title</u>
38382	Test Fixture Rig
38383	Close-up of Tire & Dynamometer
38384	Close-up of Tire and Dynamometer

LOG OF TEST:

<u>Date</u>	
10-10-58	Received test tire.
10-31-58	Started static test runs.
11-25-58	Vertical load phase of test completed.
12-1-58	Side load phase of test completed.
12-12-58	Drag load phase of test completed.
12-18-58	Torque load phase of test completed.

FAIRCHILD AIRCRAFT DIVISION

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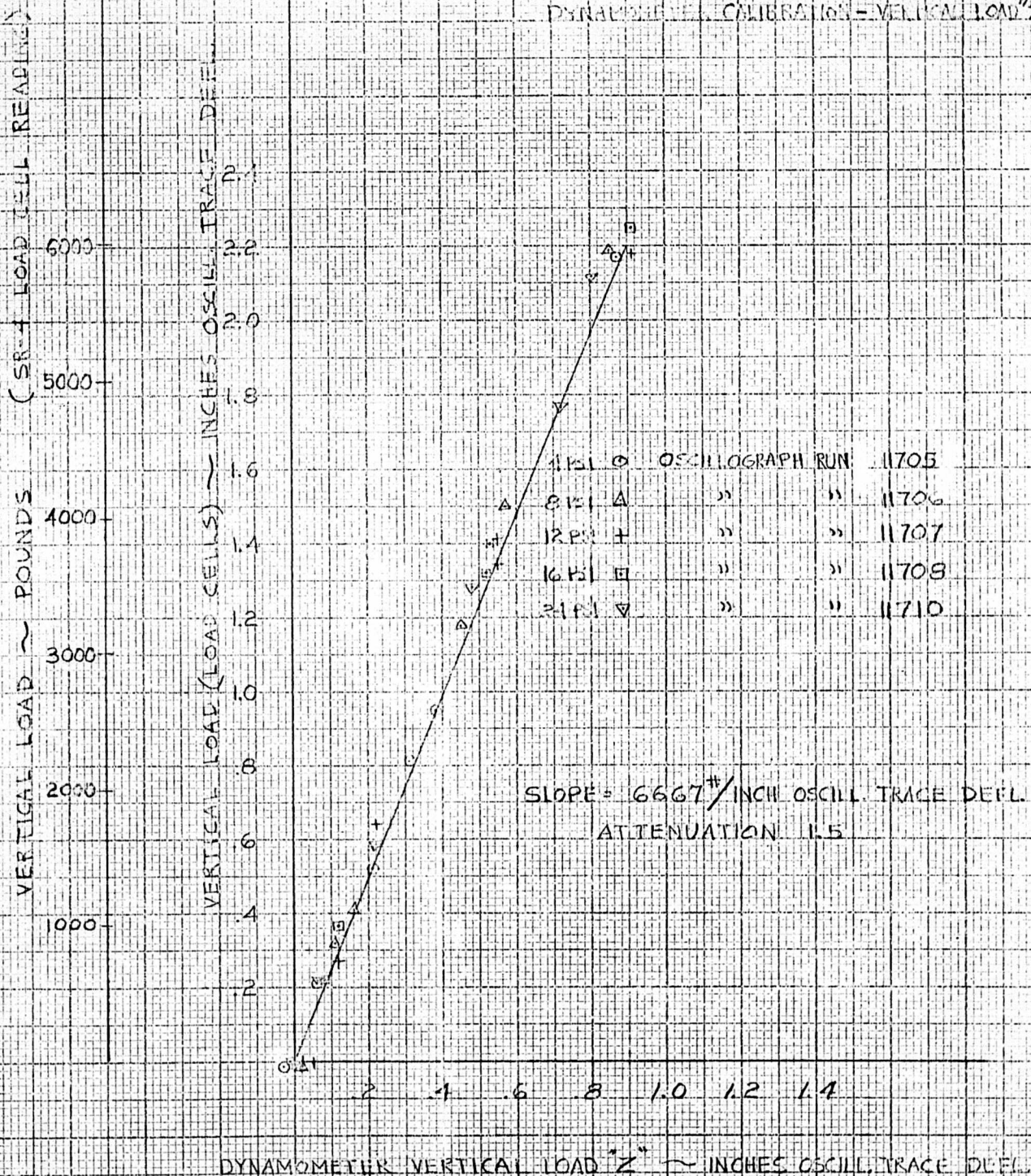
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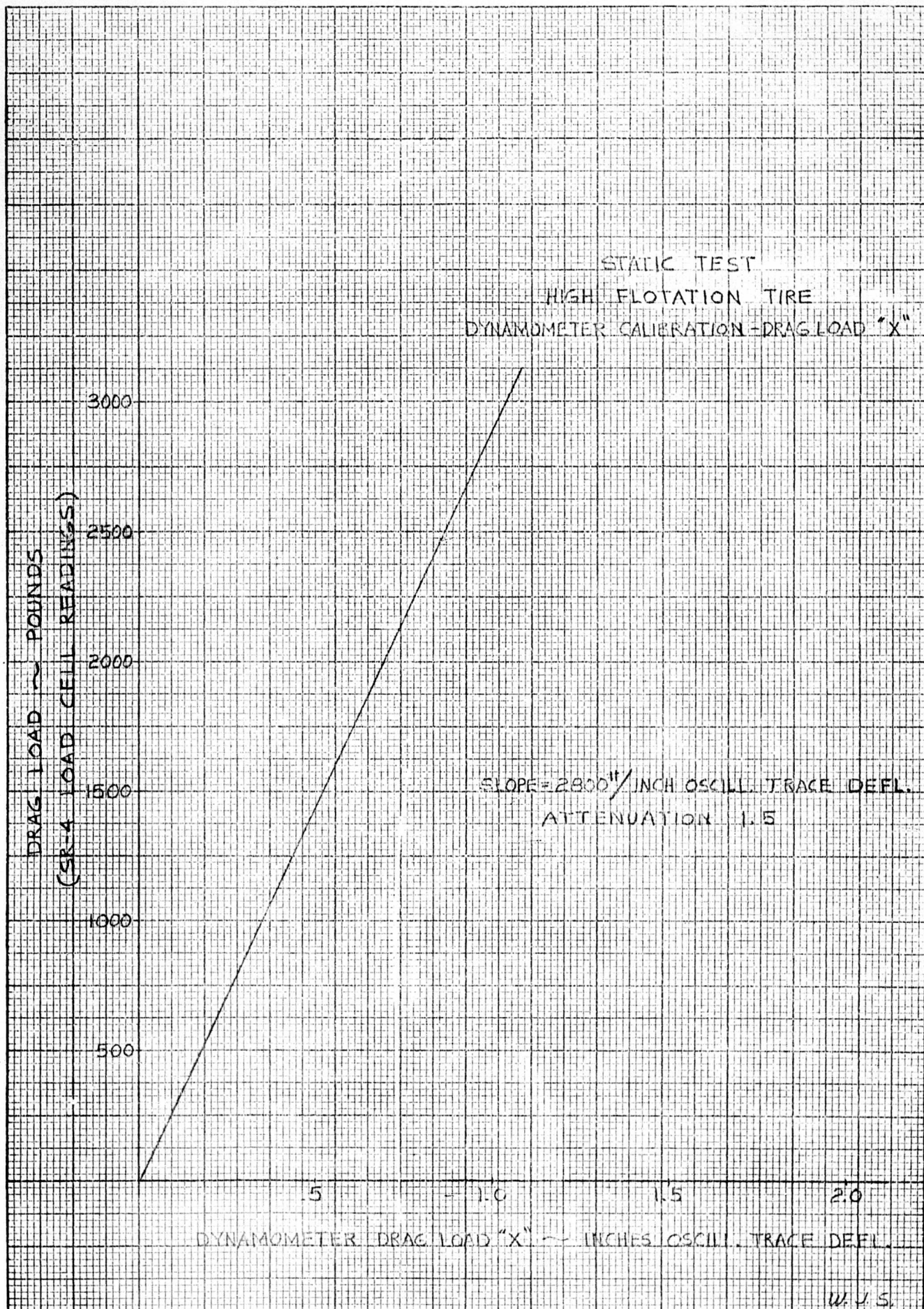
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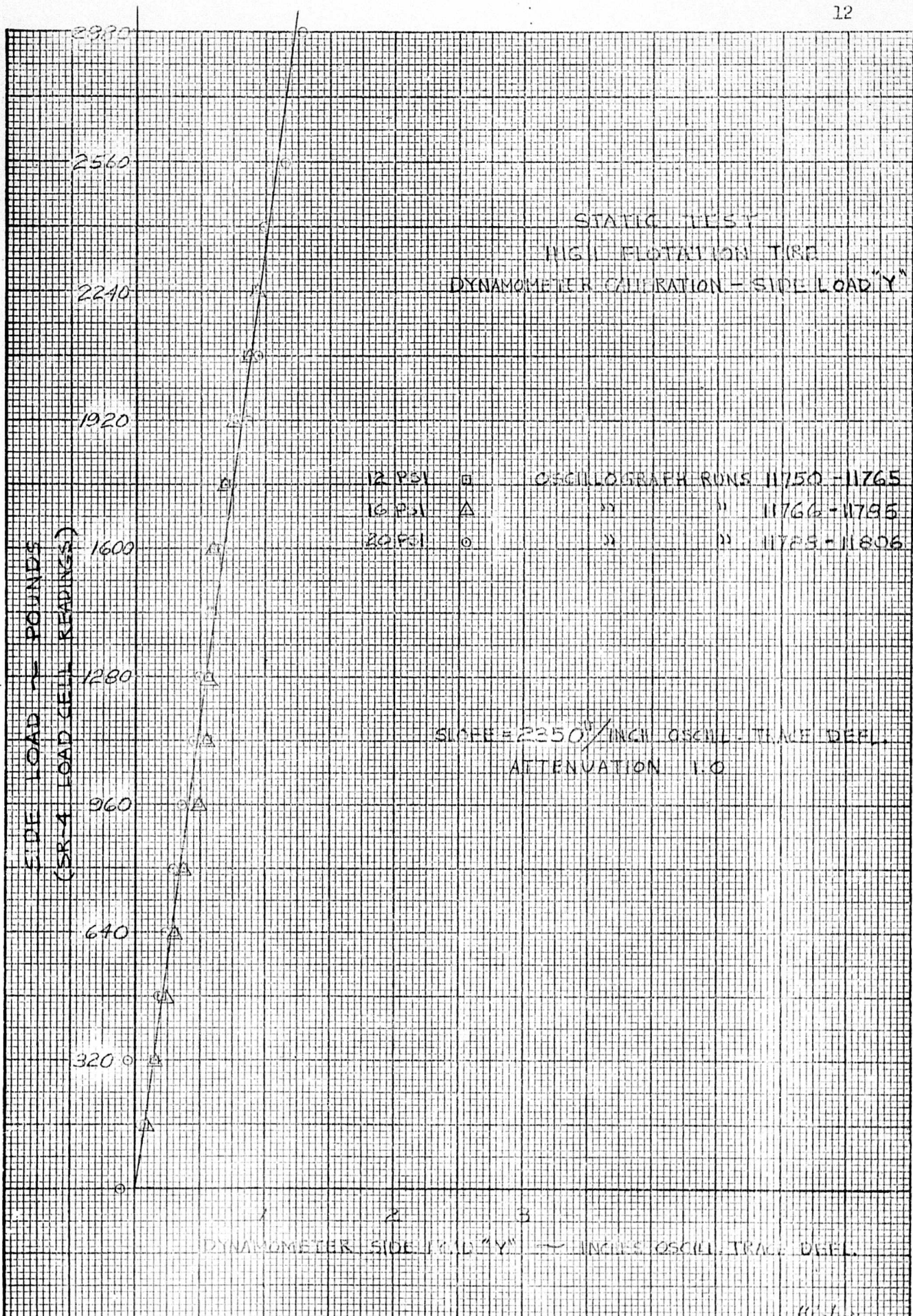
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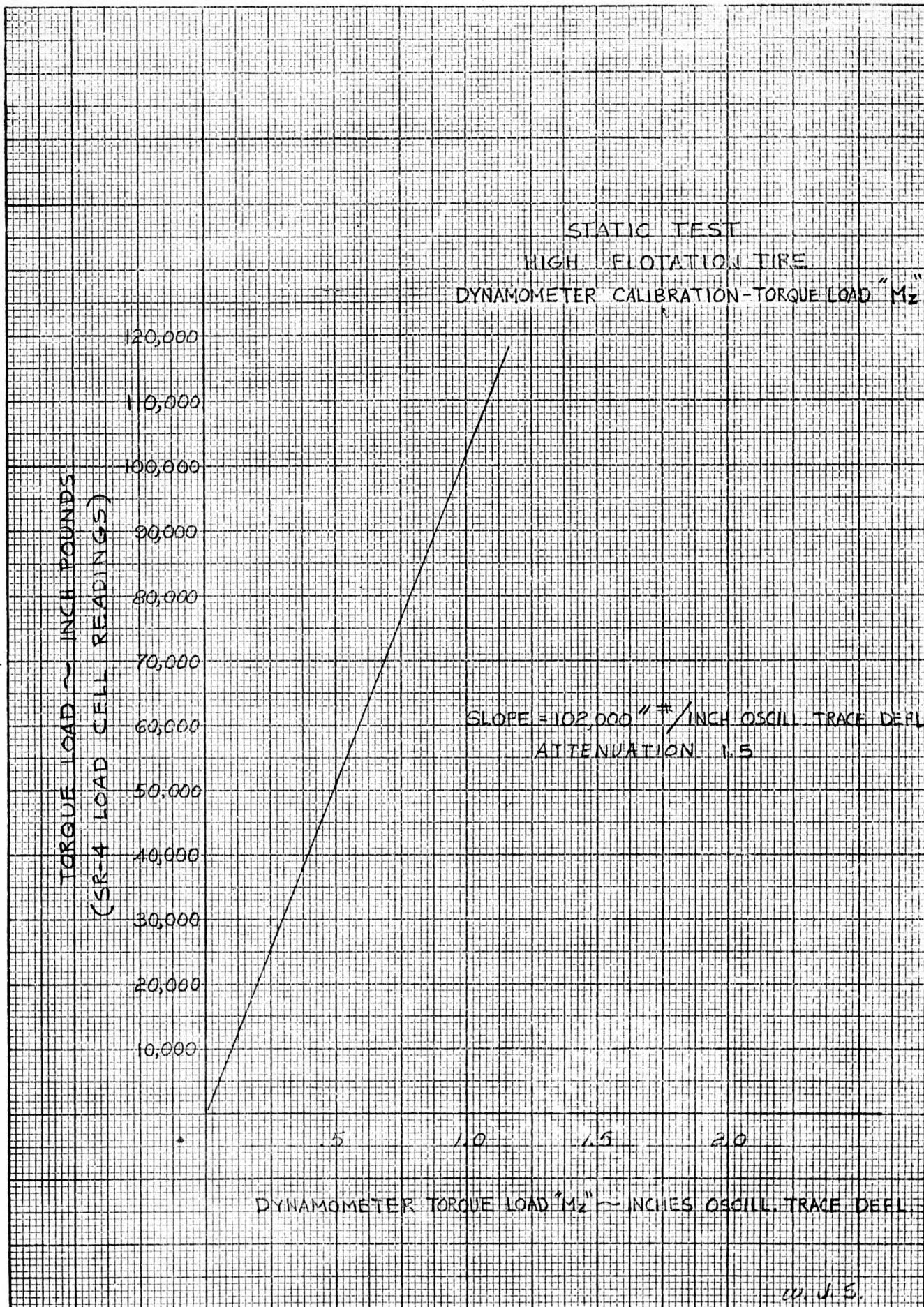
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SEATTLE TEST
HIGH FLOATION TIRE
DYNAMOMETER CALIBRATION - VERTICAL LOAD "Z"

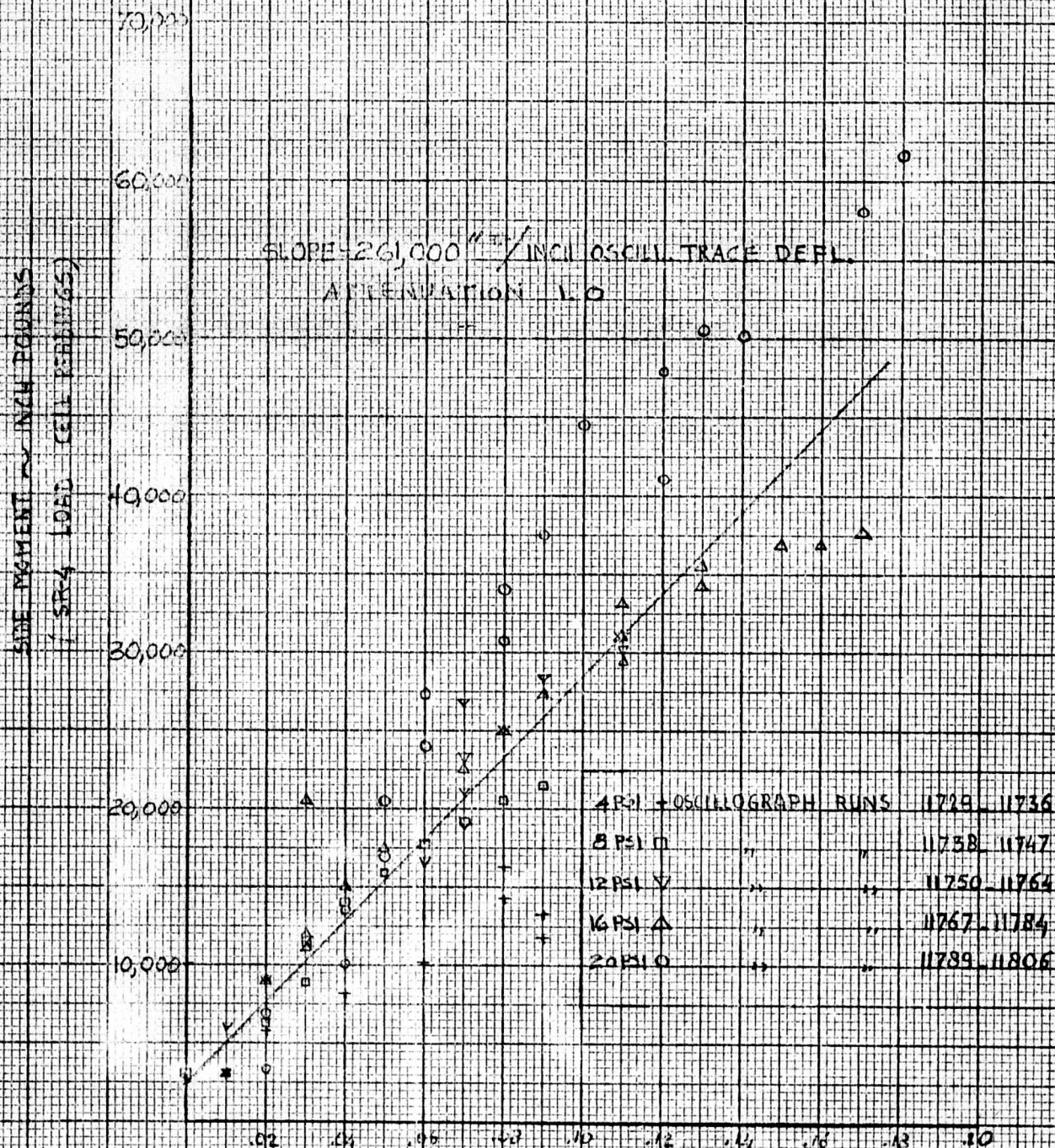








STATIC TEST
HIGH FLOTATION TIRE
DYNAMOMETER CALIBRATION SIDE MOMENT "M_x"



DYNAMOMETER SIDE MOMENT "M_x" ~ INCHES OSCILL. TRACE DEFL.

STATIC TEST
HIGH FLOTATION TIRE
DYNACOMPUTER CALIBRATION - DRAG MOMENT "M_y"

PSI	OSCILLOGRAPH RUNS	1910 - 1917
5 PSI	□	1920 - 1929
12 PSI	▽	1930 - 1939
16 PSI	△	1940 - 1949
25 PSI	○	1950 - 1959

5000

4000

3000

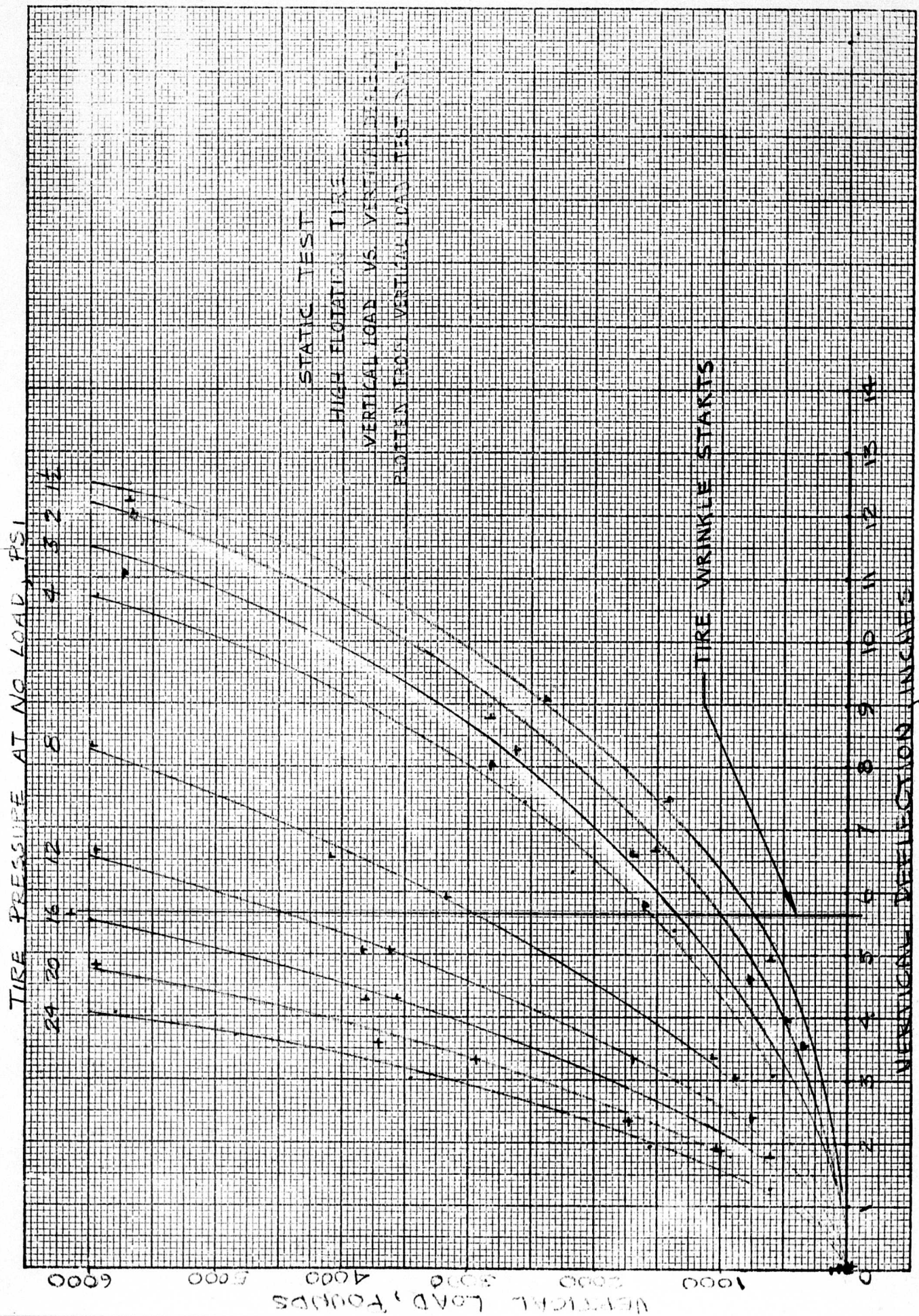
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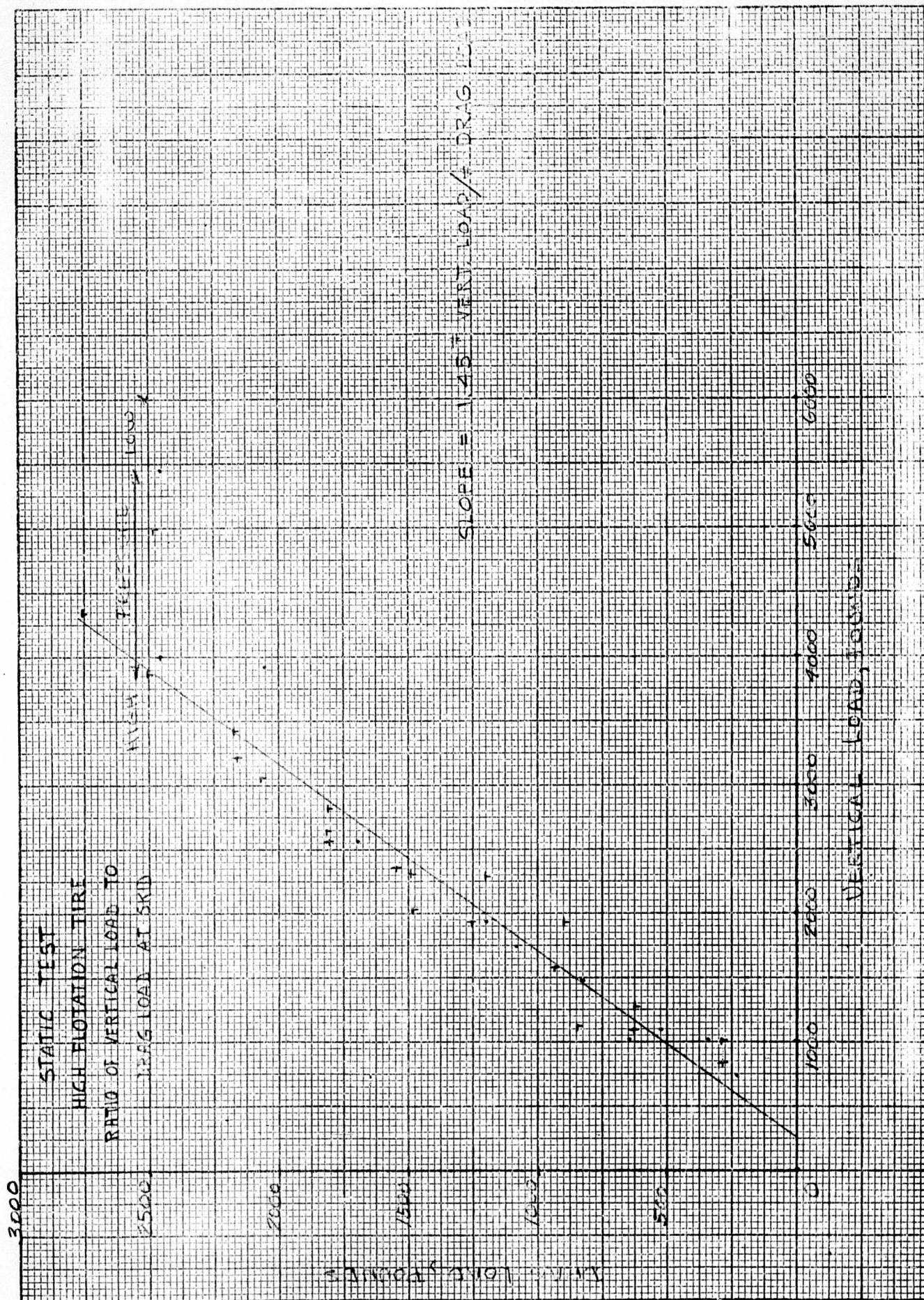
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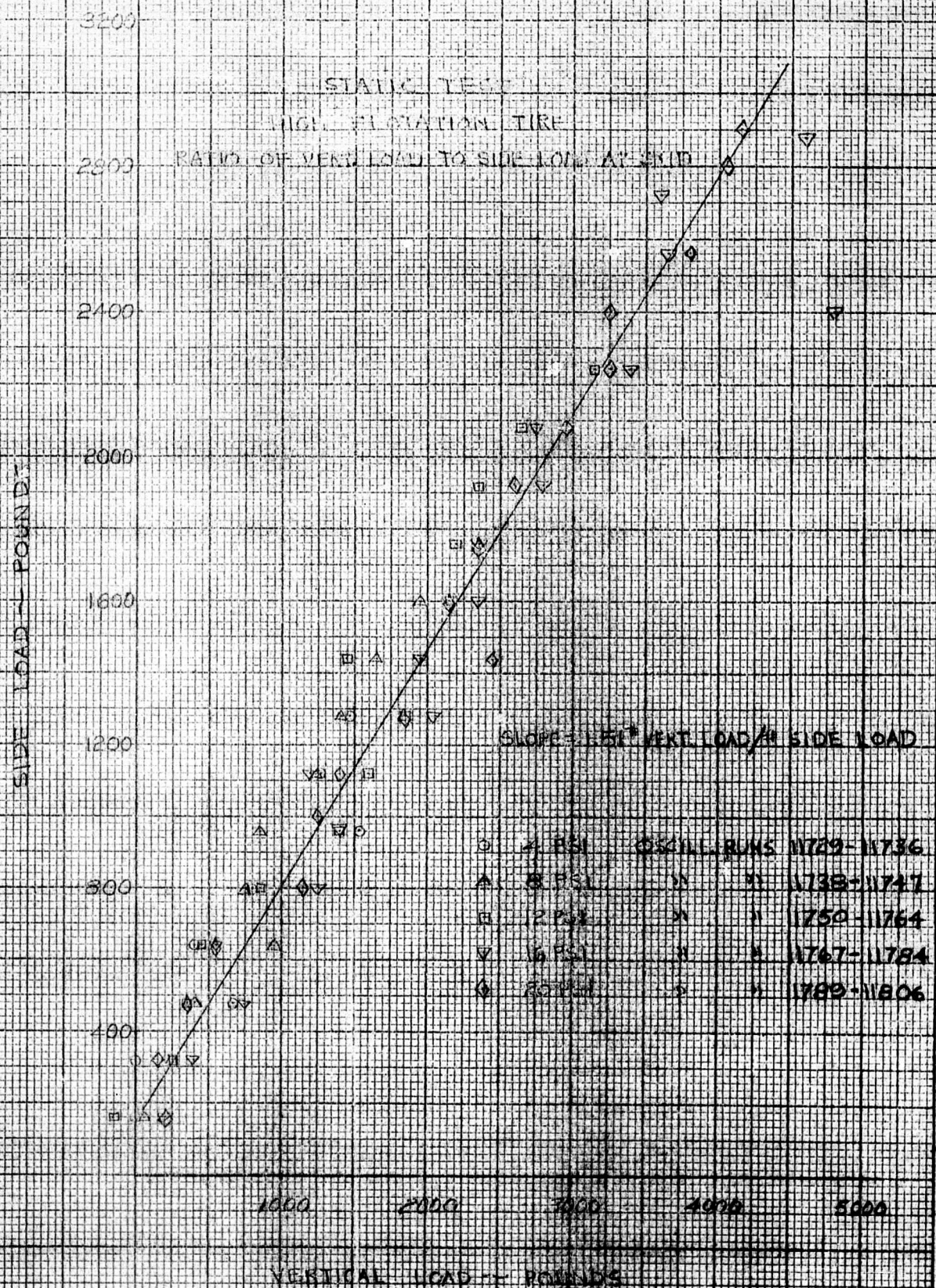
SLOPE = 35,700 "*/INCH OSCILL. TRACE DEFL.
ATTENUATION 1.5

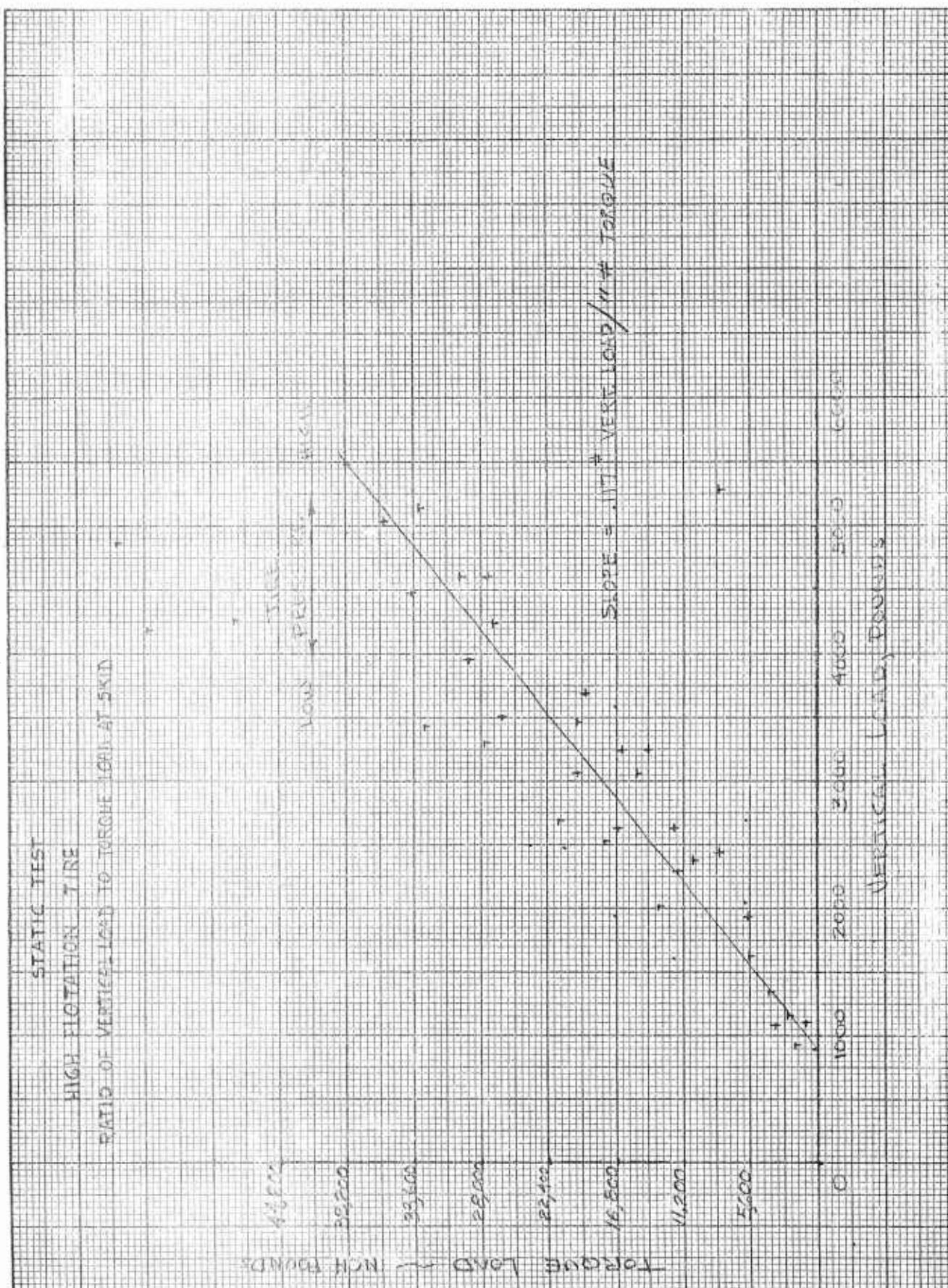
DYNAMOMETER DRAG MOMENT "M_y" IN INCHES OSCILL. TRACE DEFL.

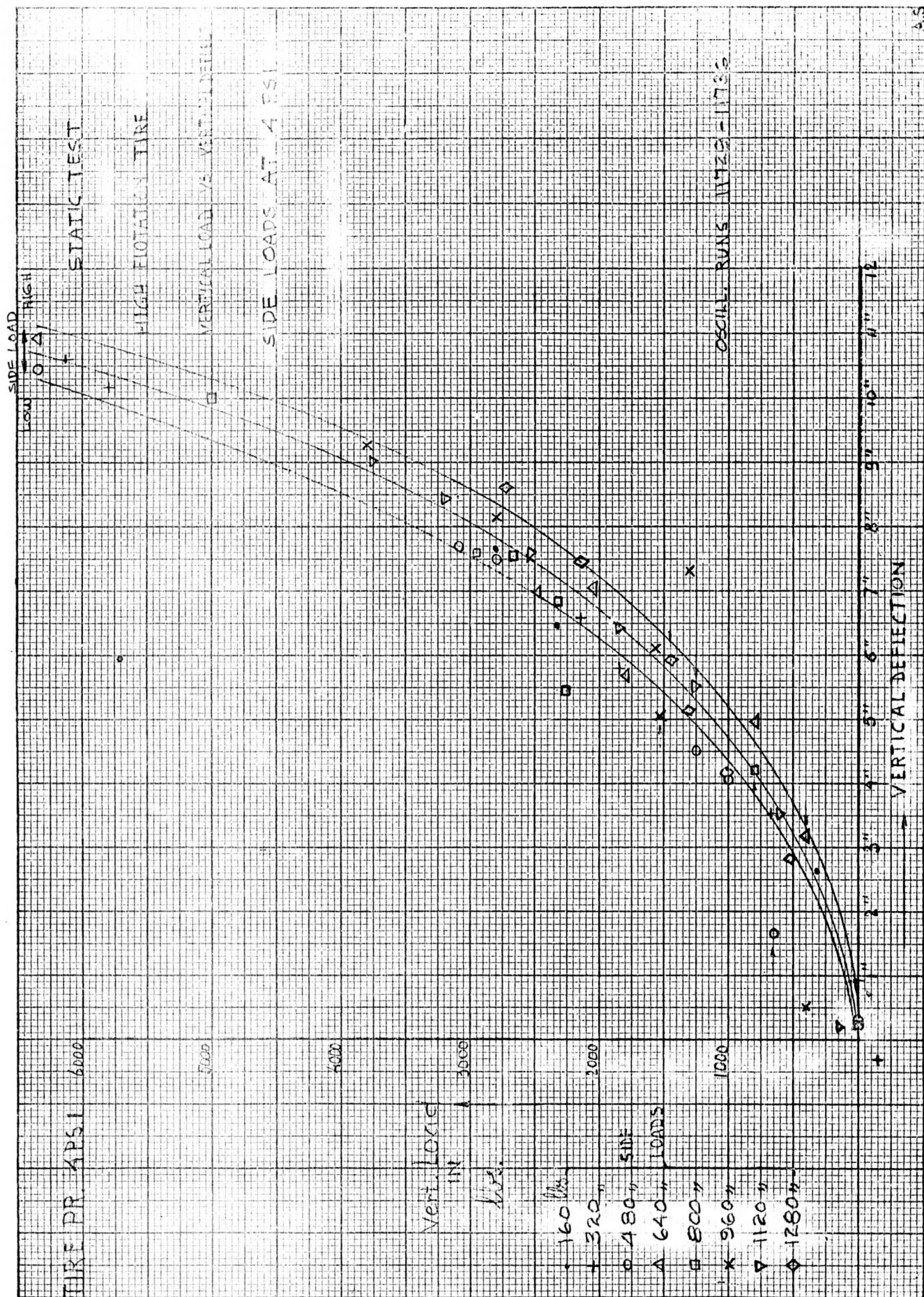
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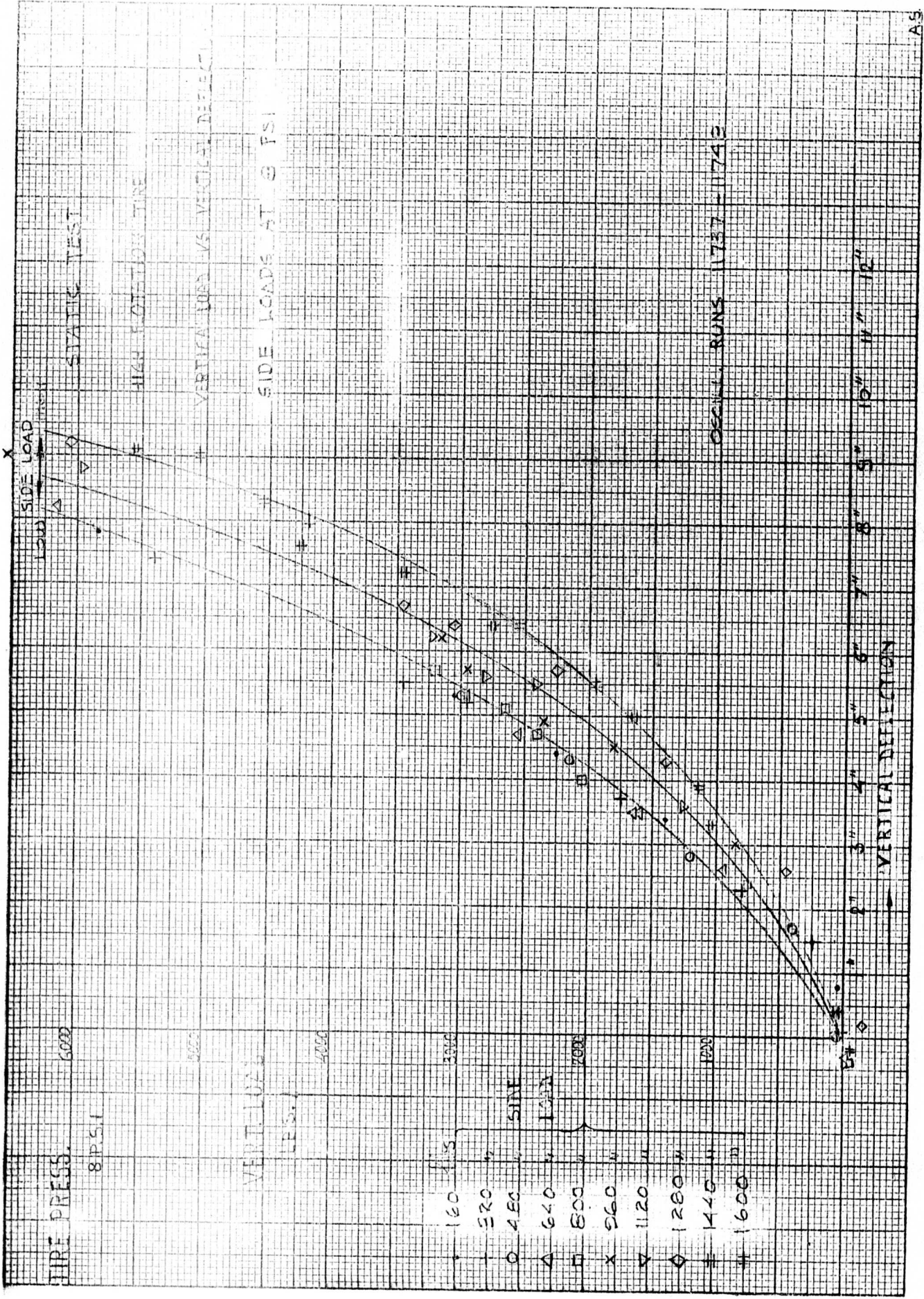


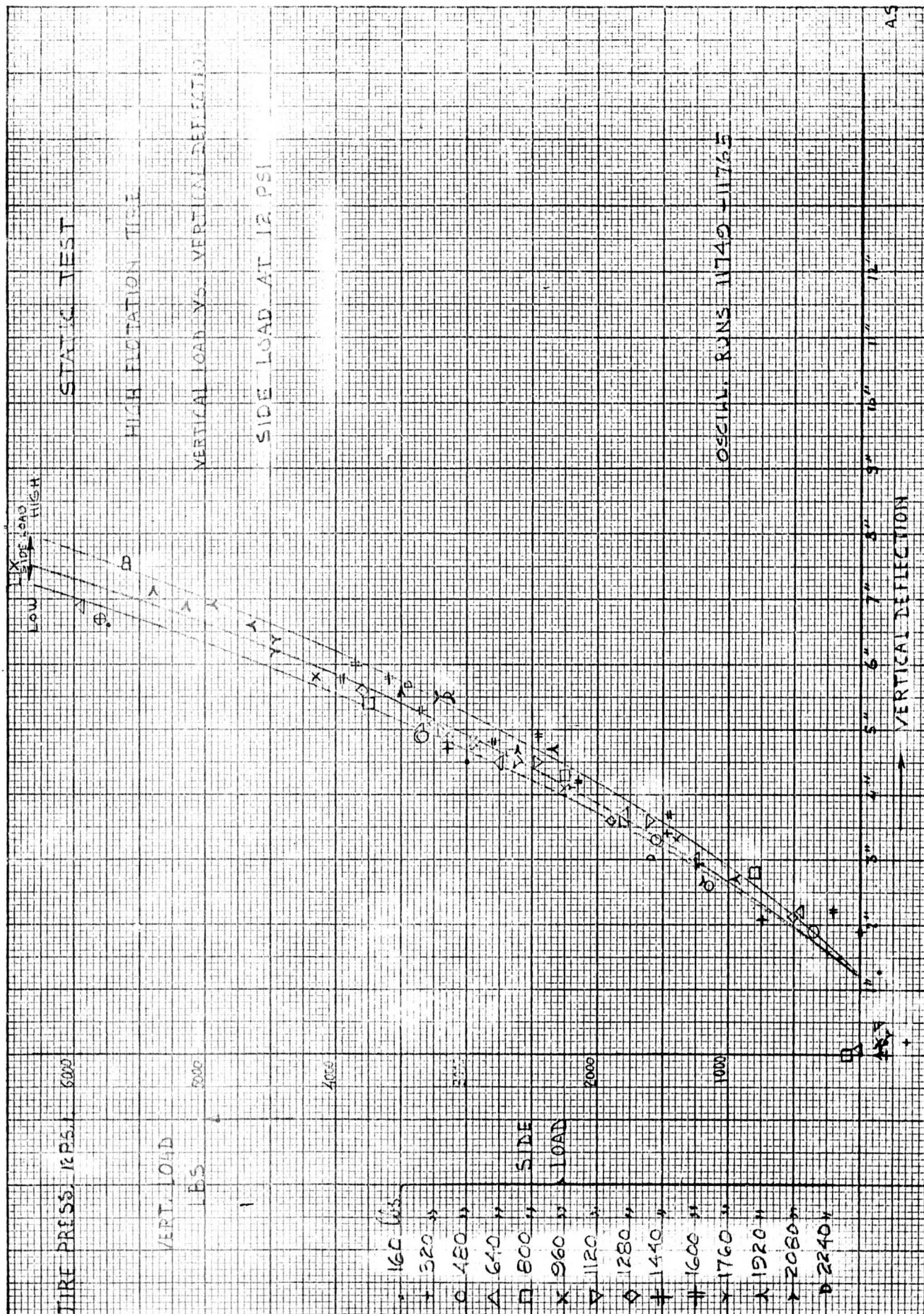


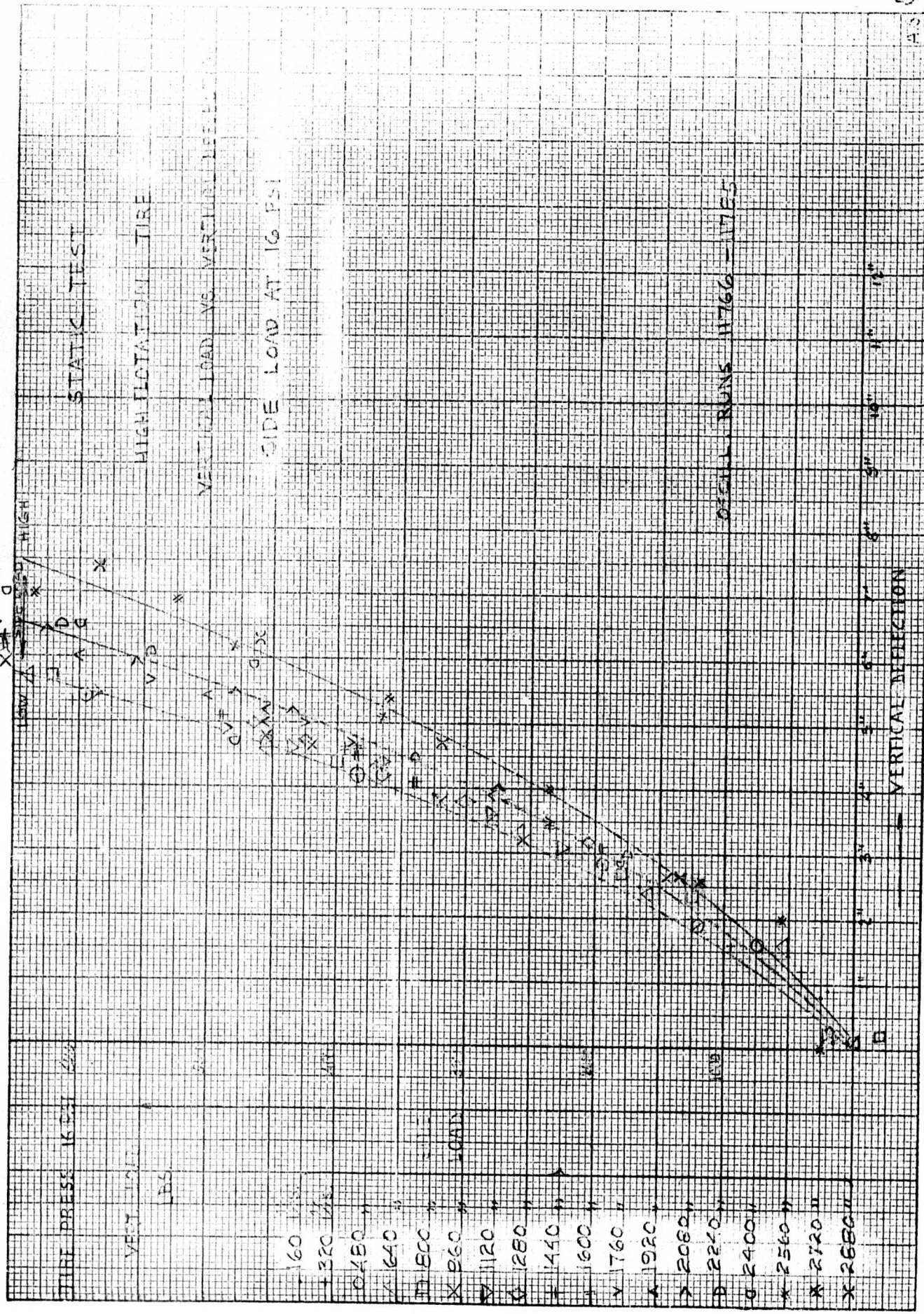












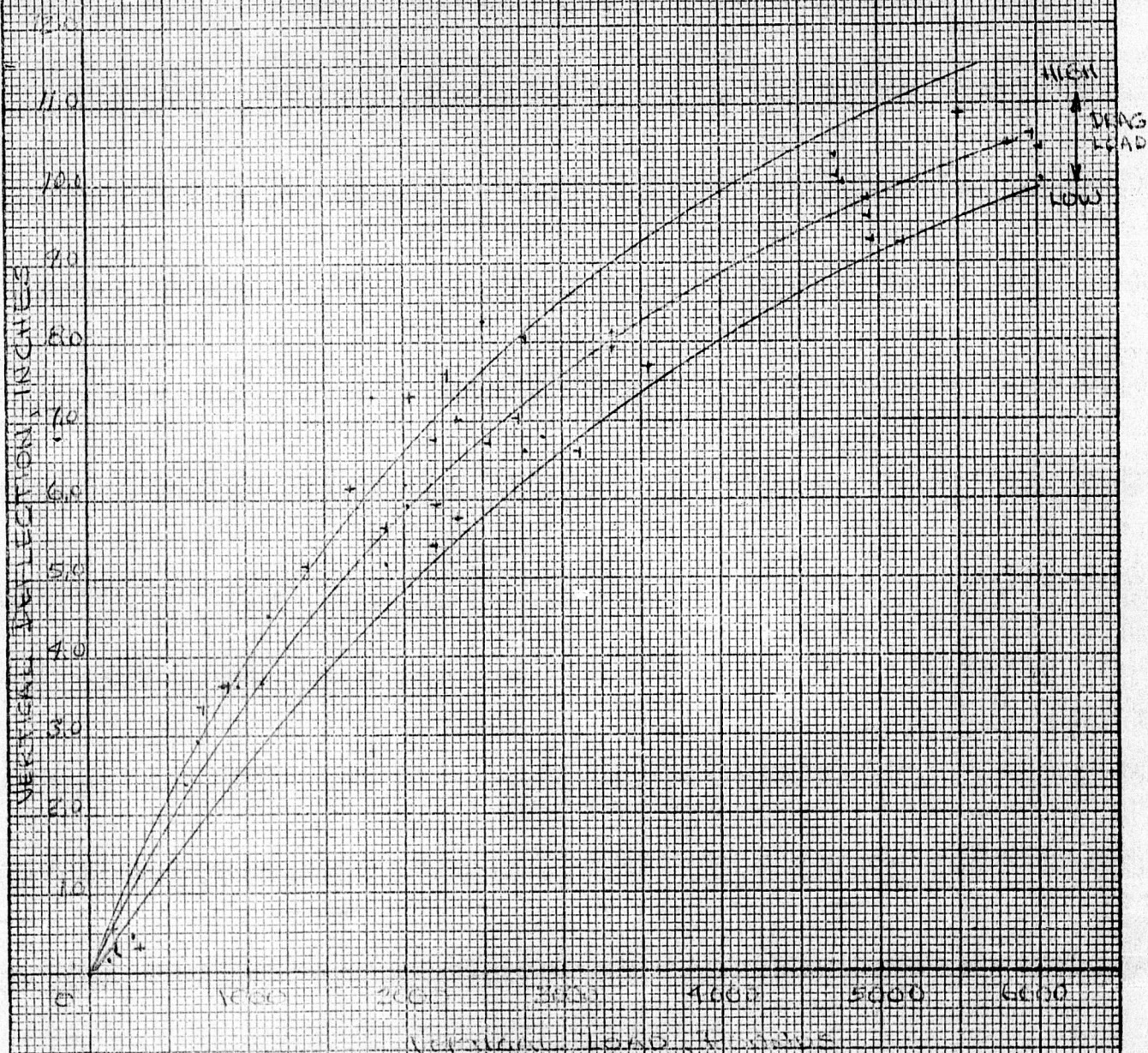
STABILITY TEST

HIGH FLUTTER TEST

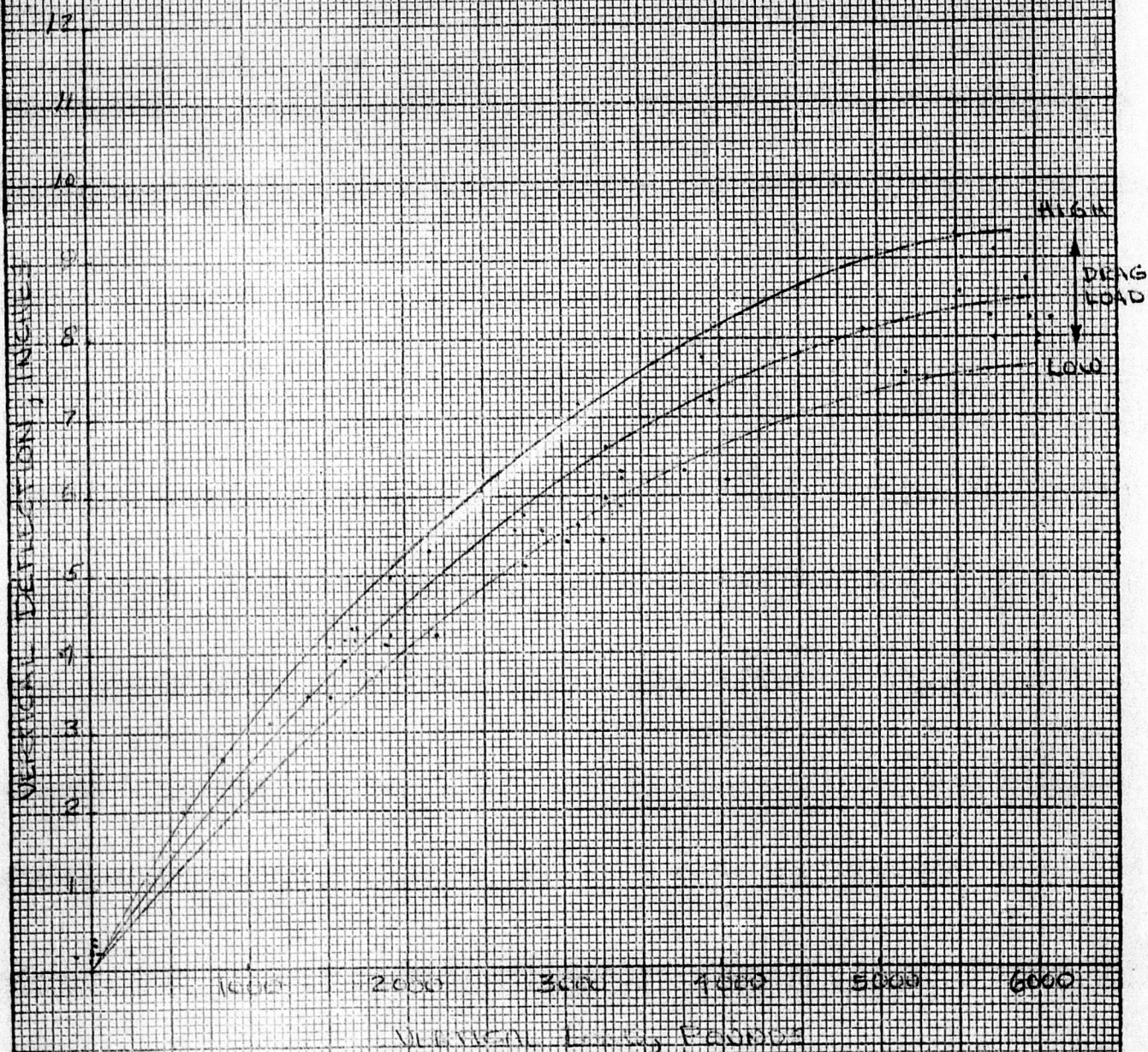
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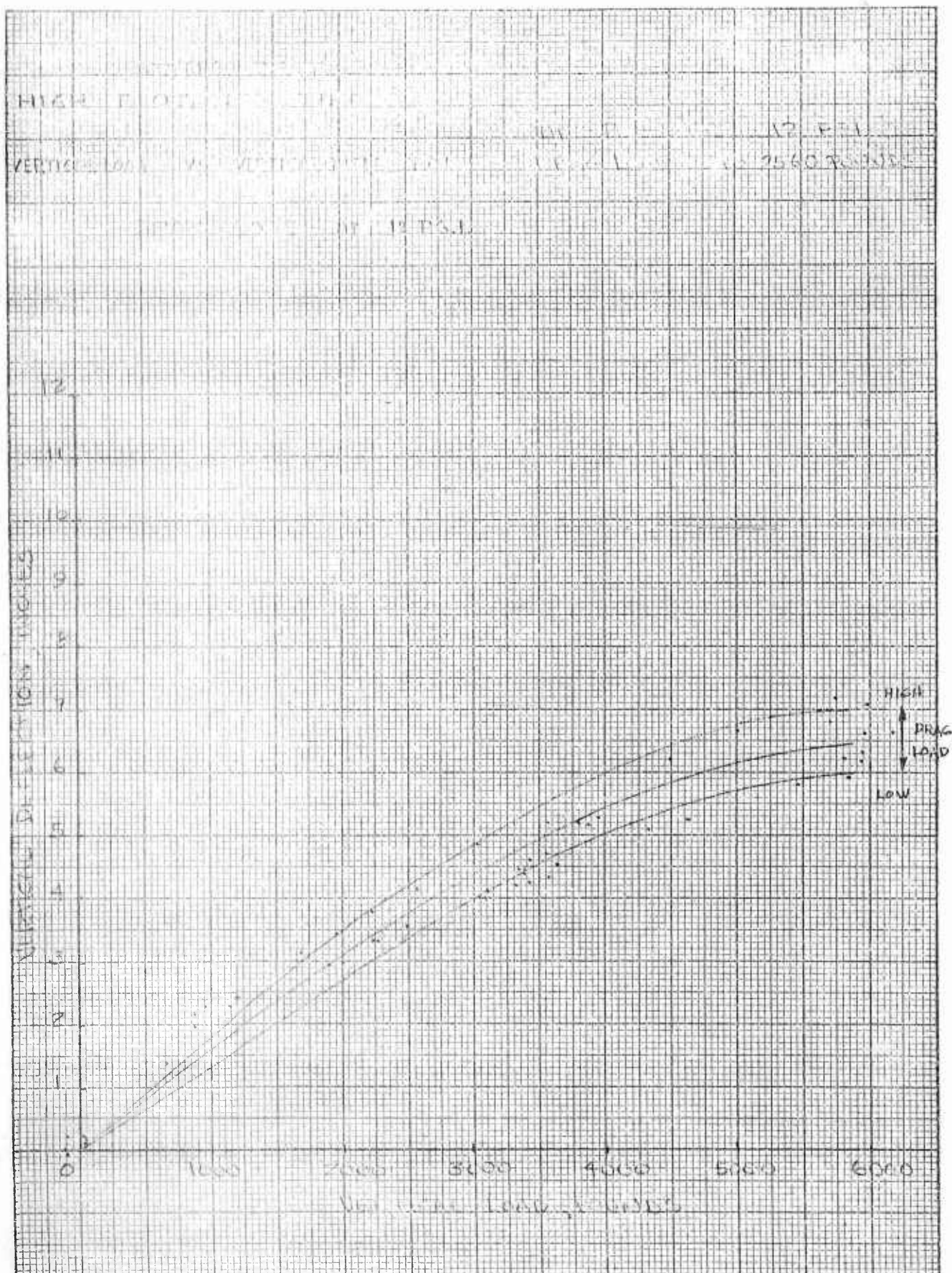
VERTICAL LOAD VS. V. (1000 LBS) 0 to 2250 LBS

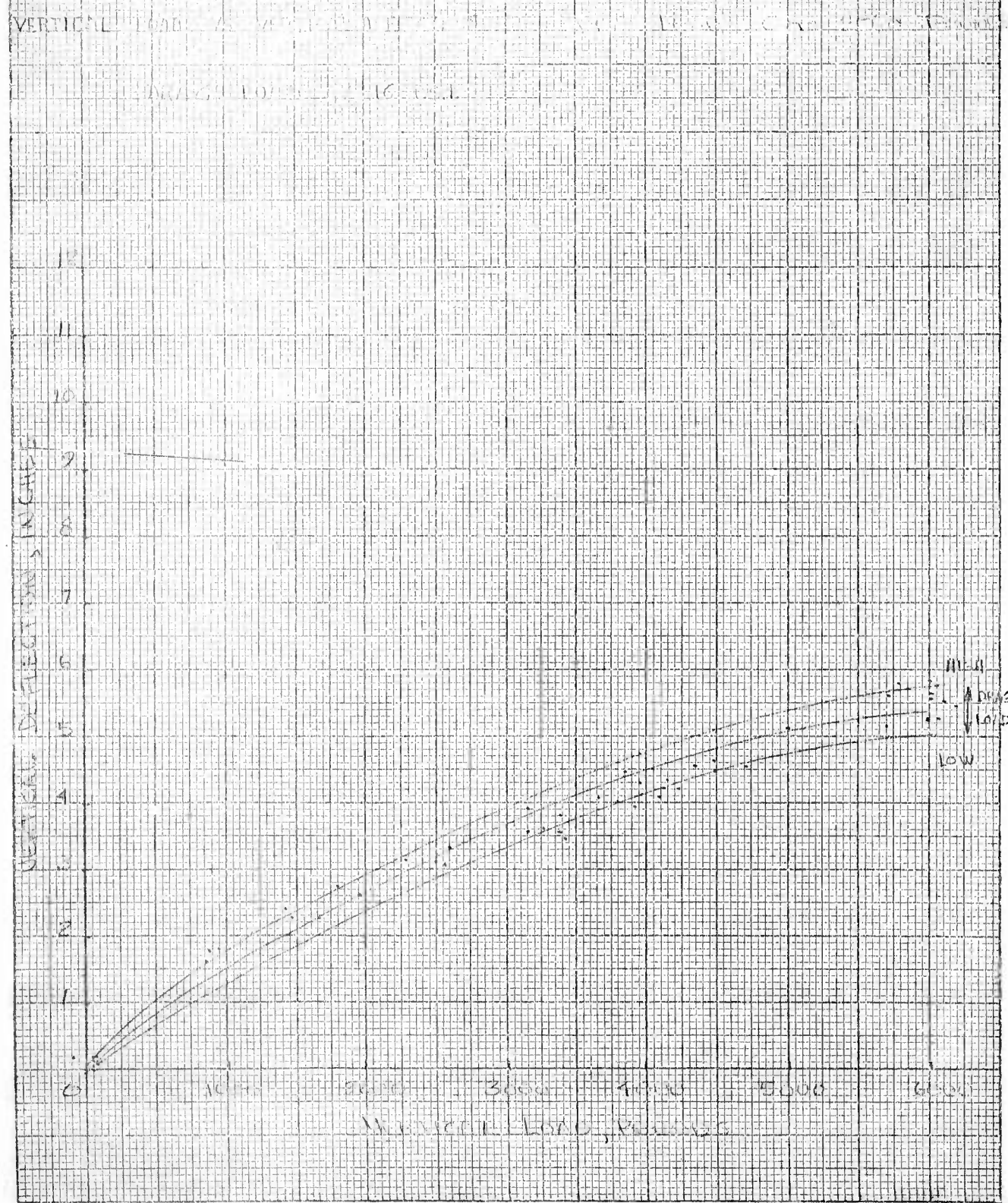
DRAG LEAD AT 4000 LBS

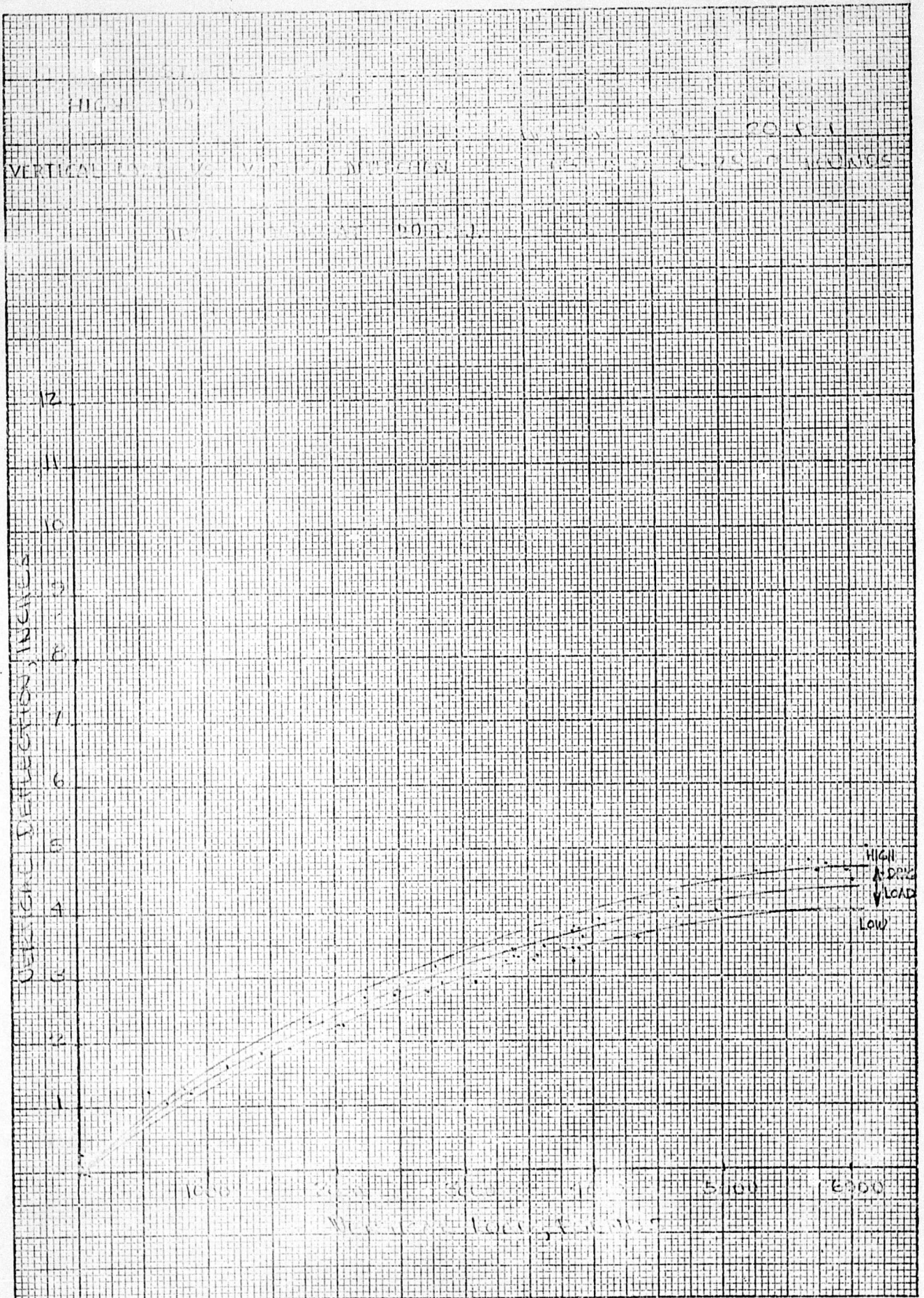


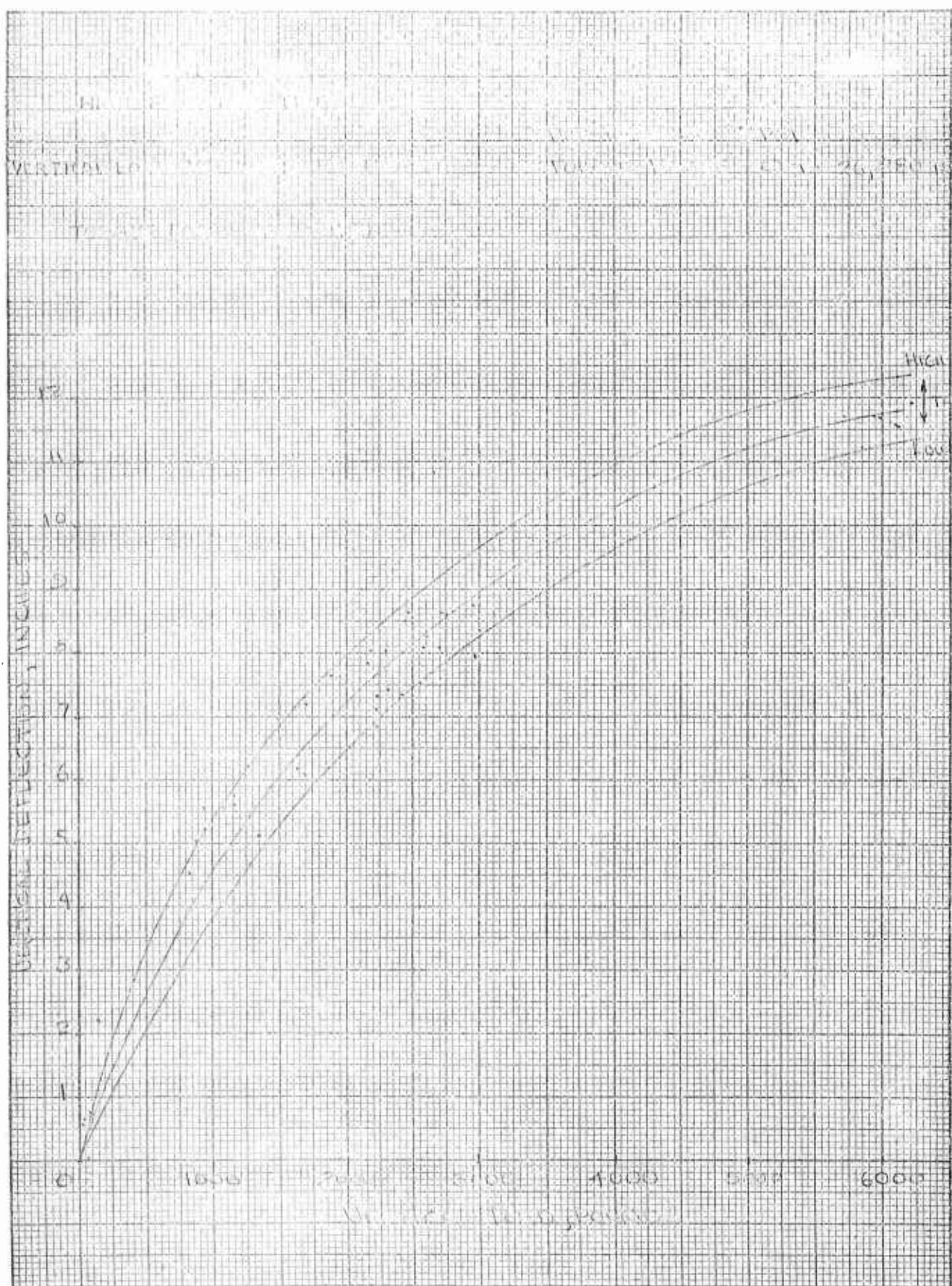
STATIC TEST
 HIGH PROJECTION TIRE
 DRAG LOAD AT 8 MPH
 VERTICAL LOAD VS VERTICAL DEFLECTION
 TIRE SIZE 0.75 25.0 POUNDS

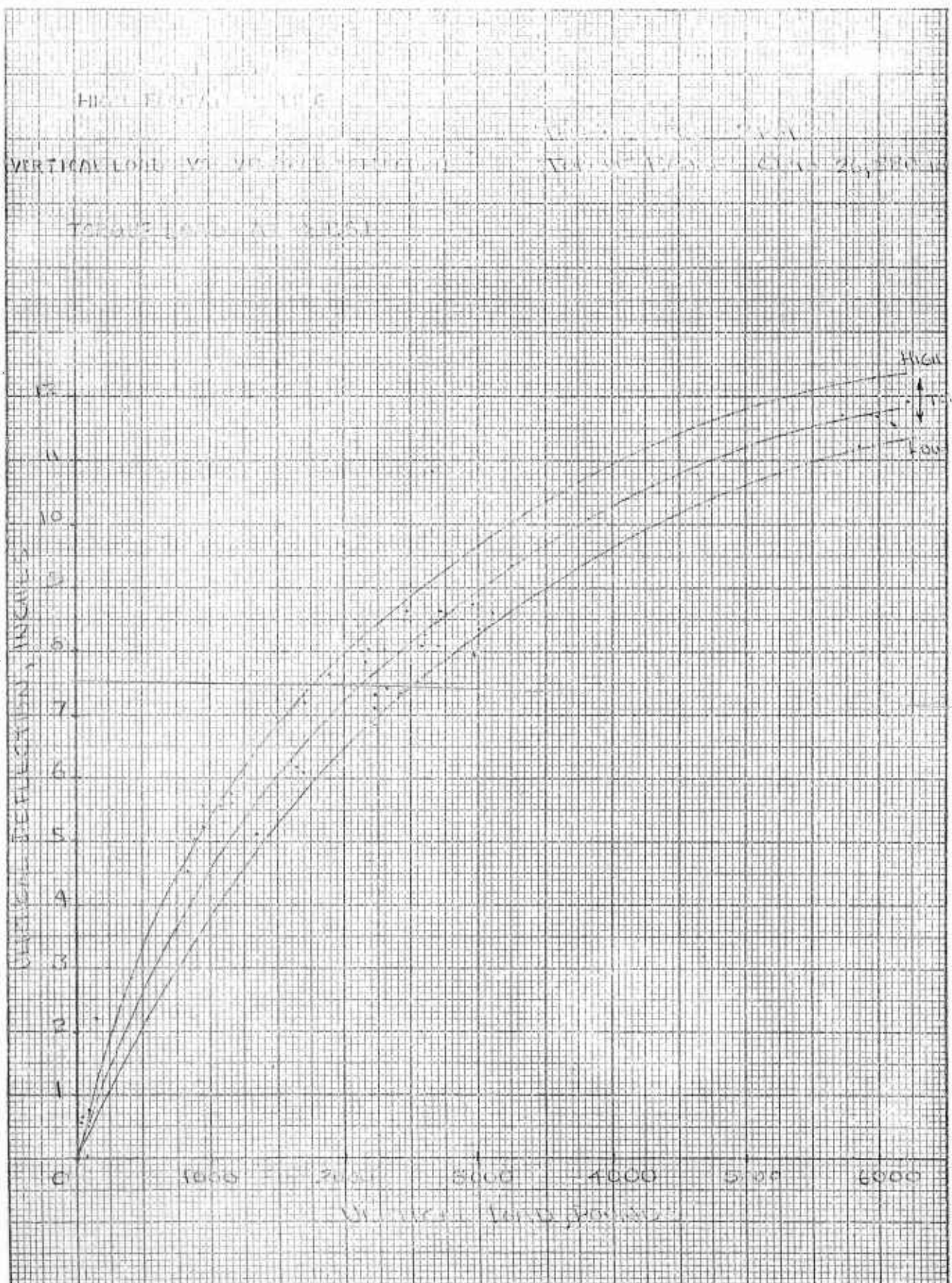












STATIC TEST

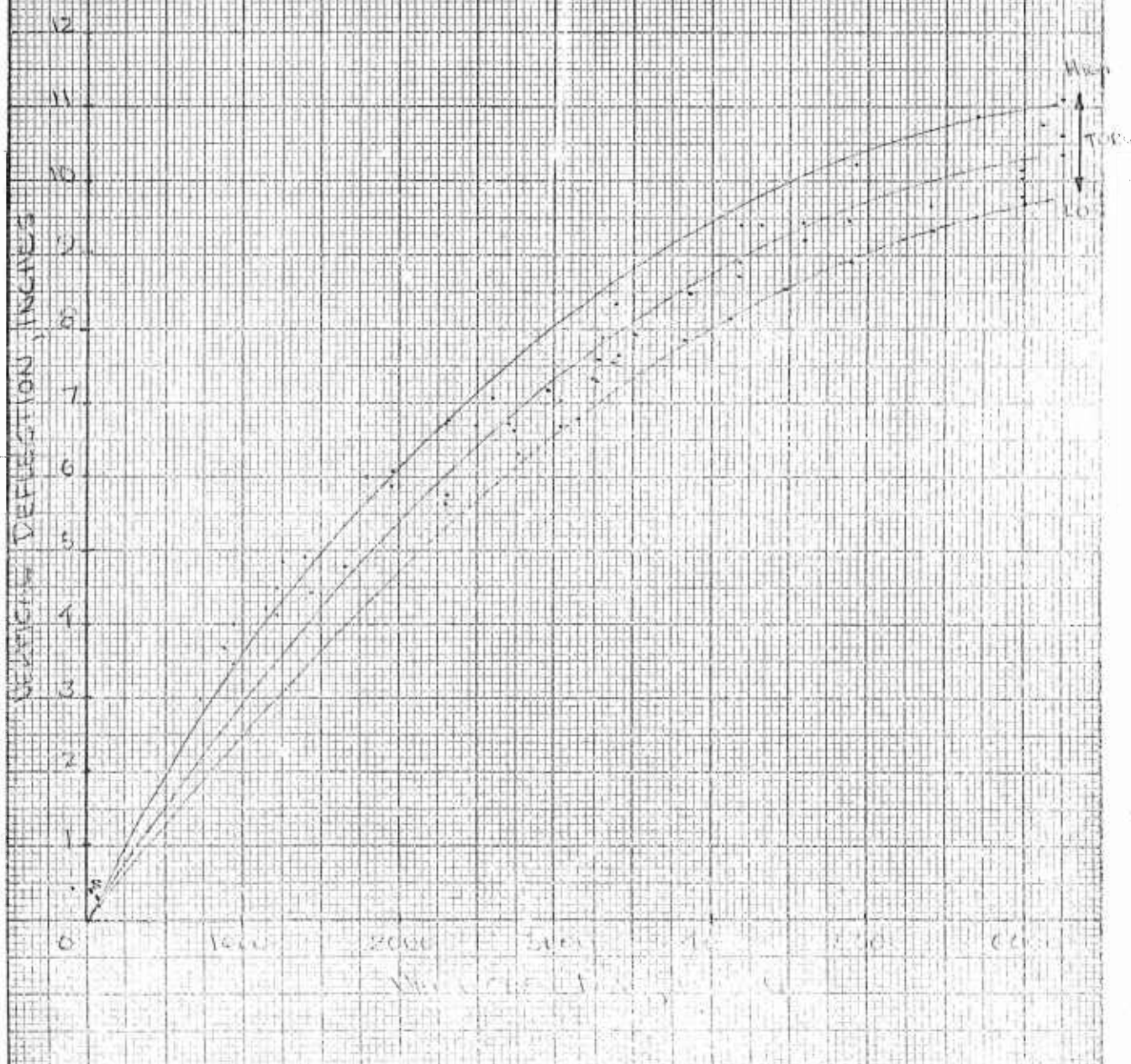
HIGH FLOTATION TIRE

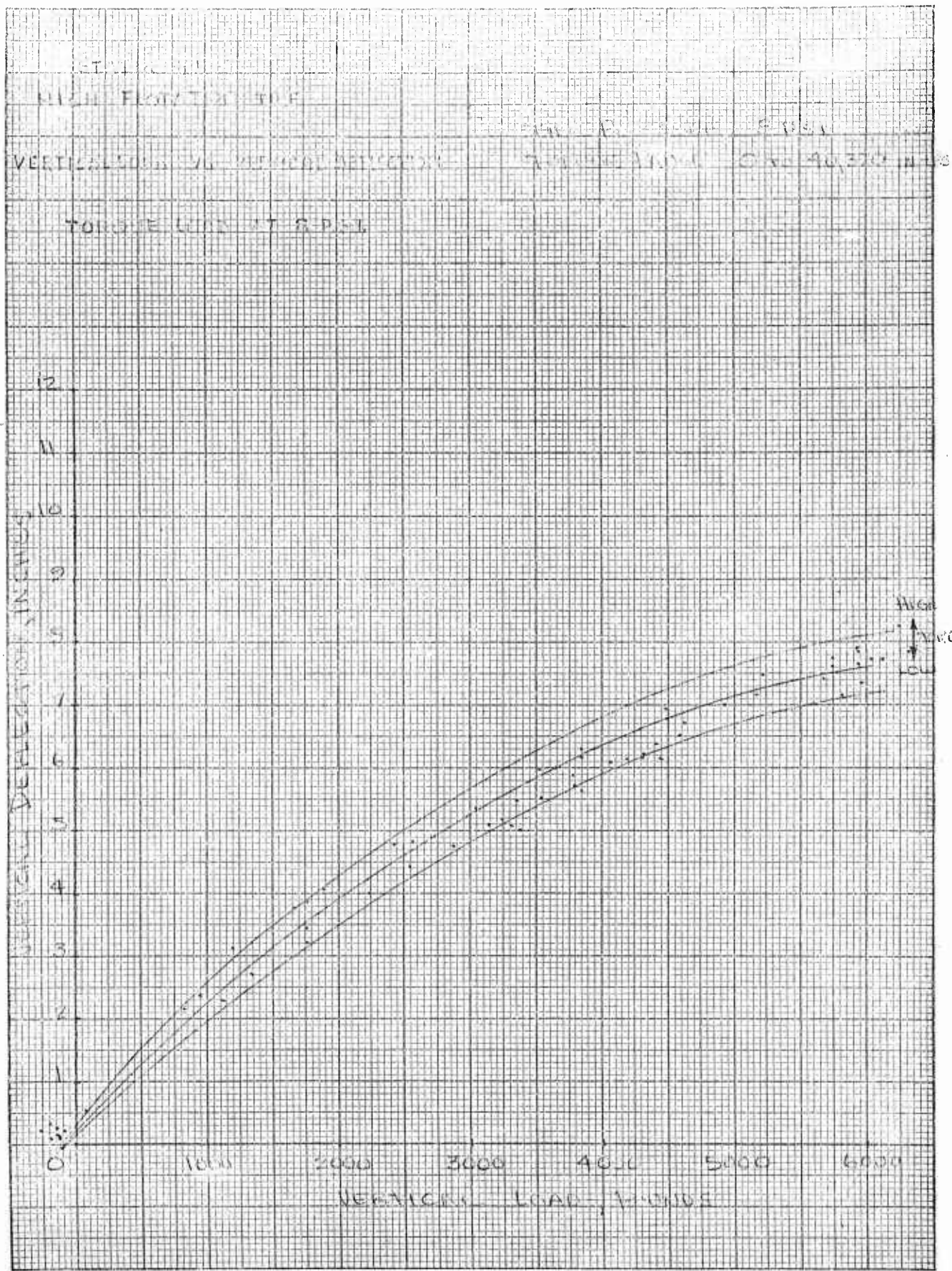
VERTICAL LOAD VS VERTICAL DEFLECTION

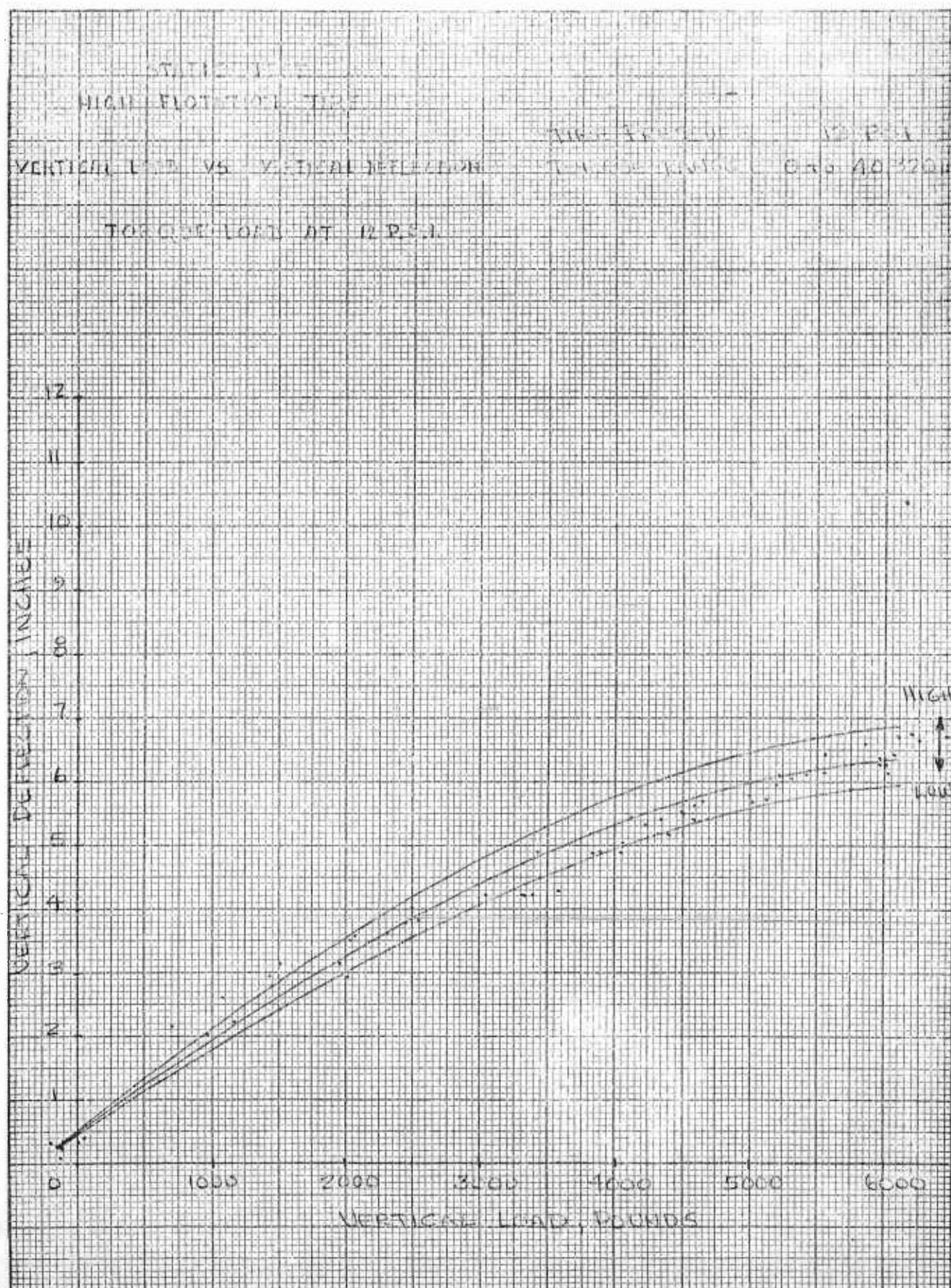
TORQUE LOAD AT 4 P.S.I.

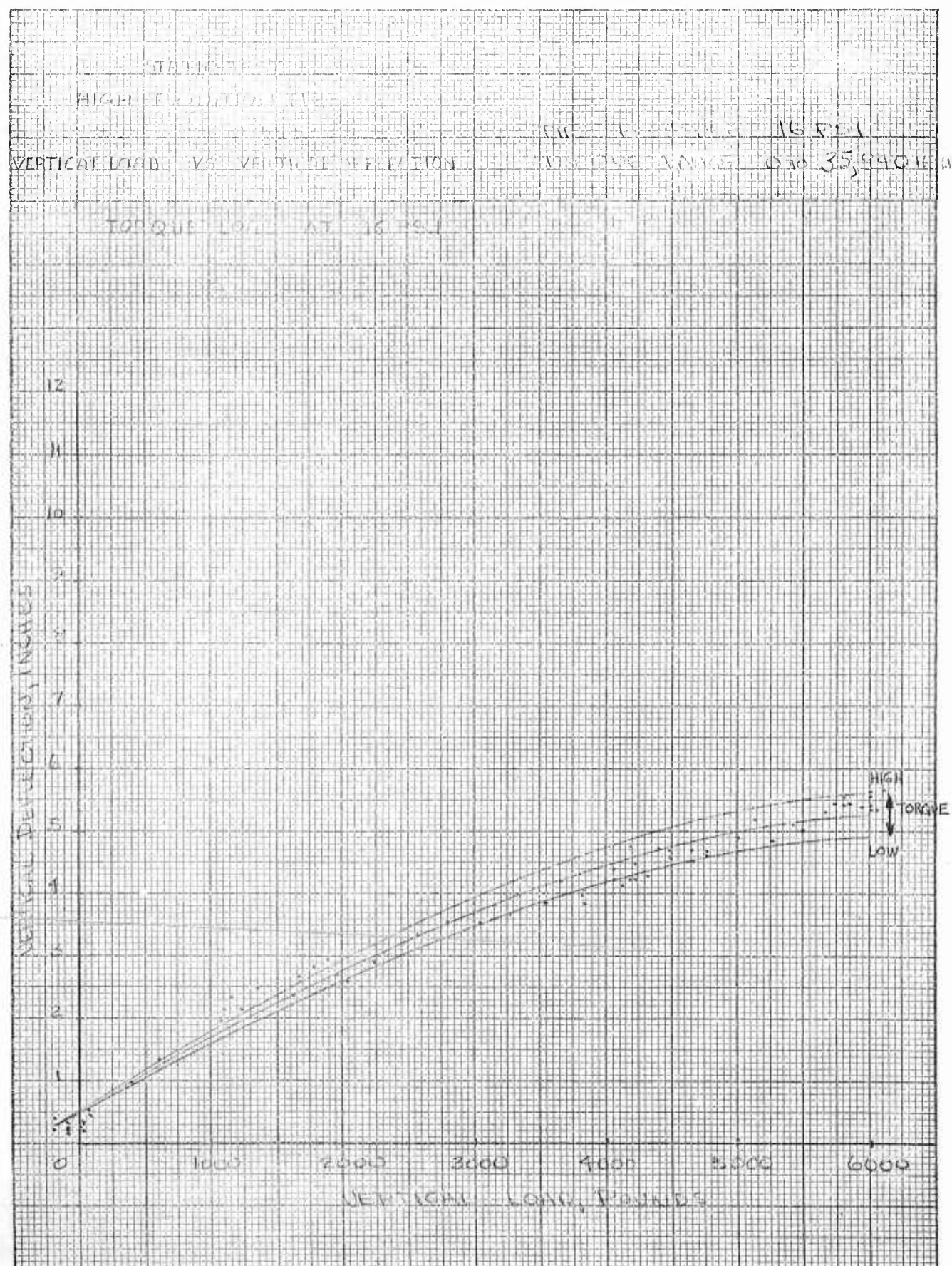
TIRE PRESSURE 4 P.S.I.

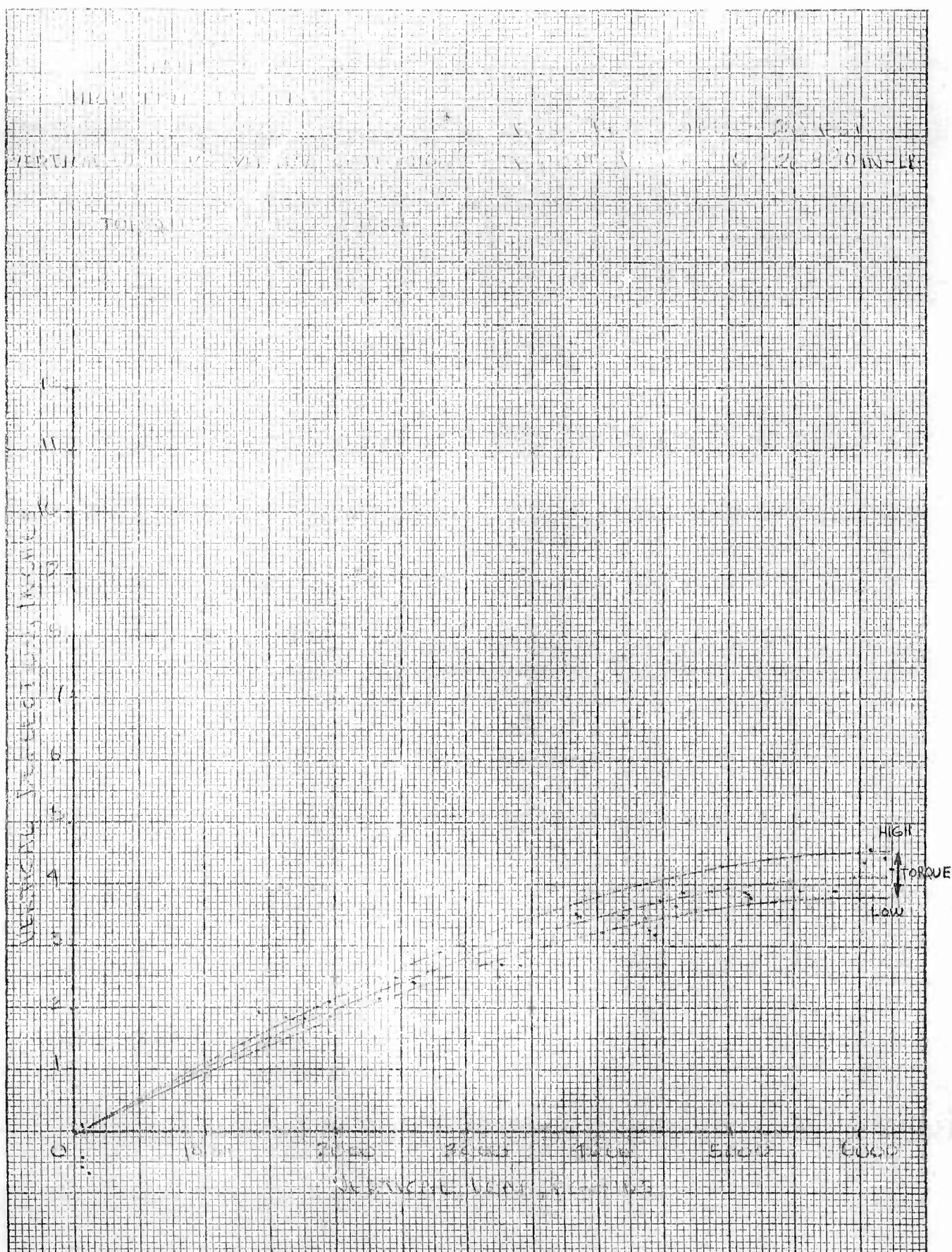
TORQUE RANGE 0 TO 44.8 AND 11.0 LB

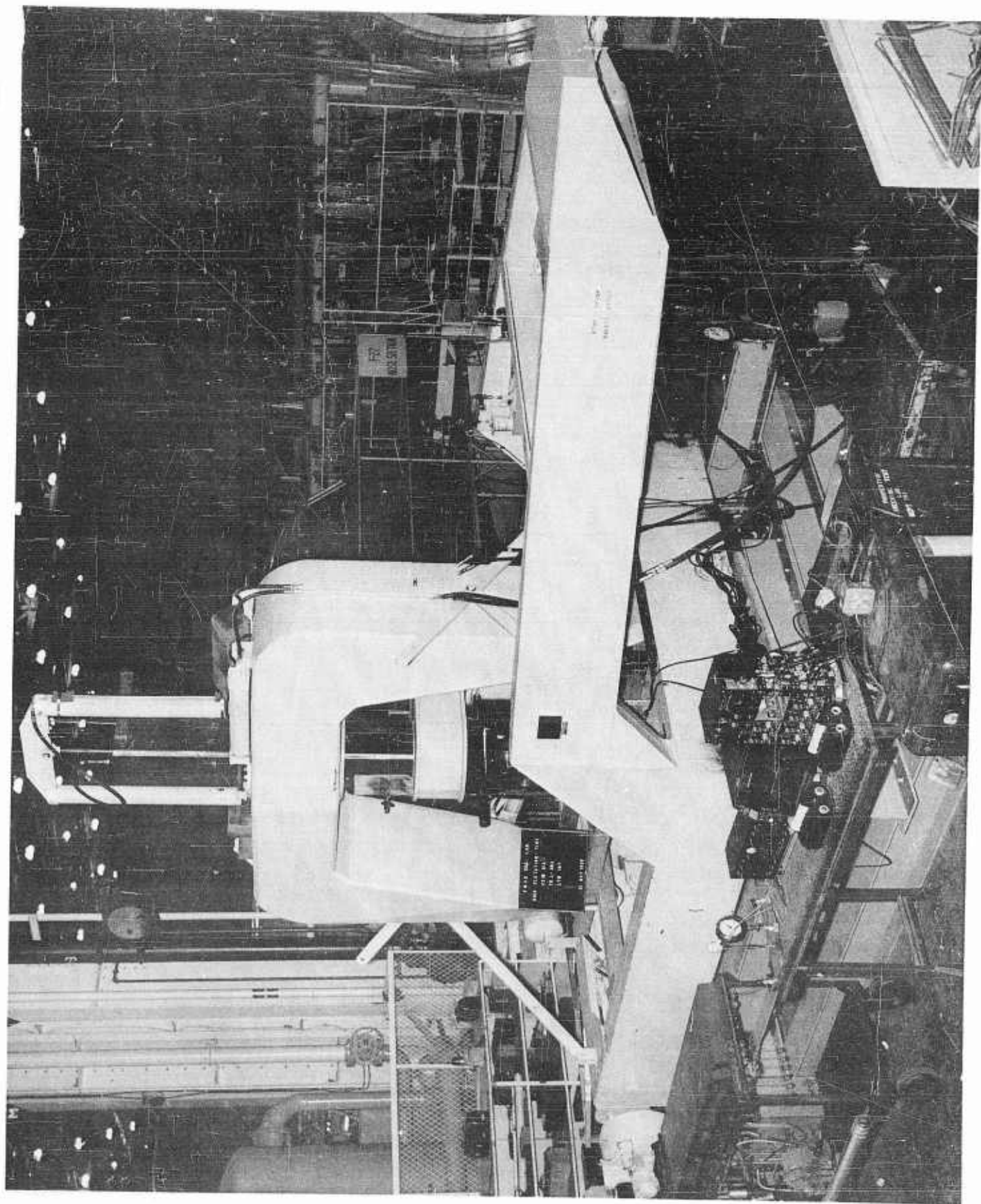


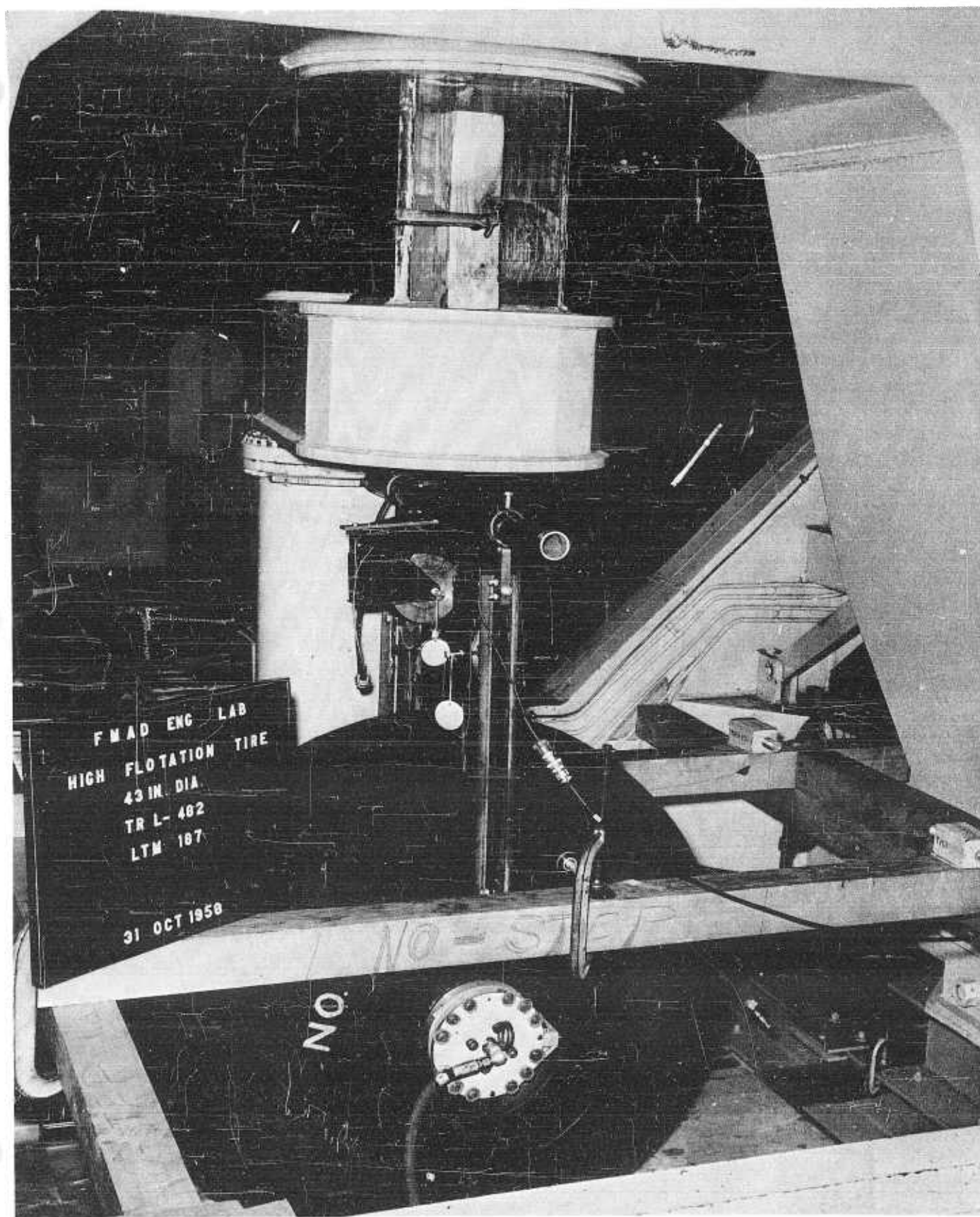


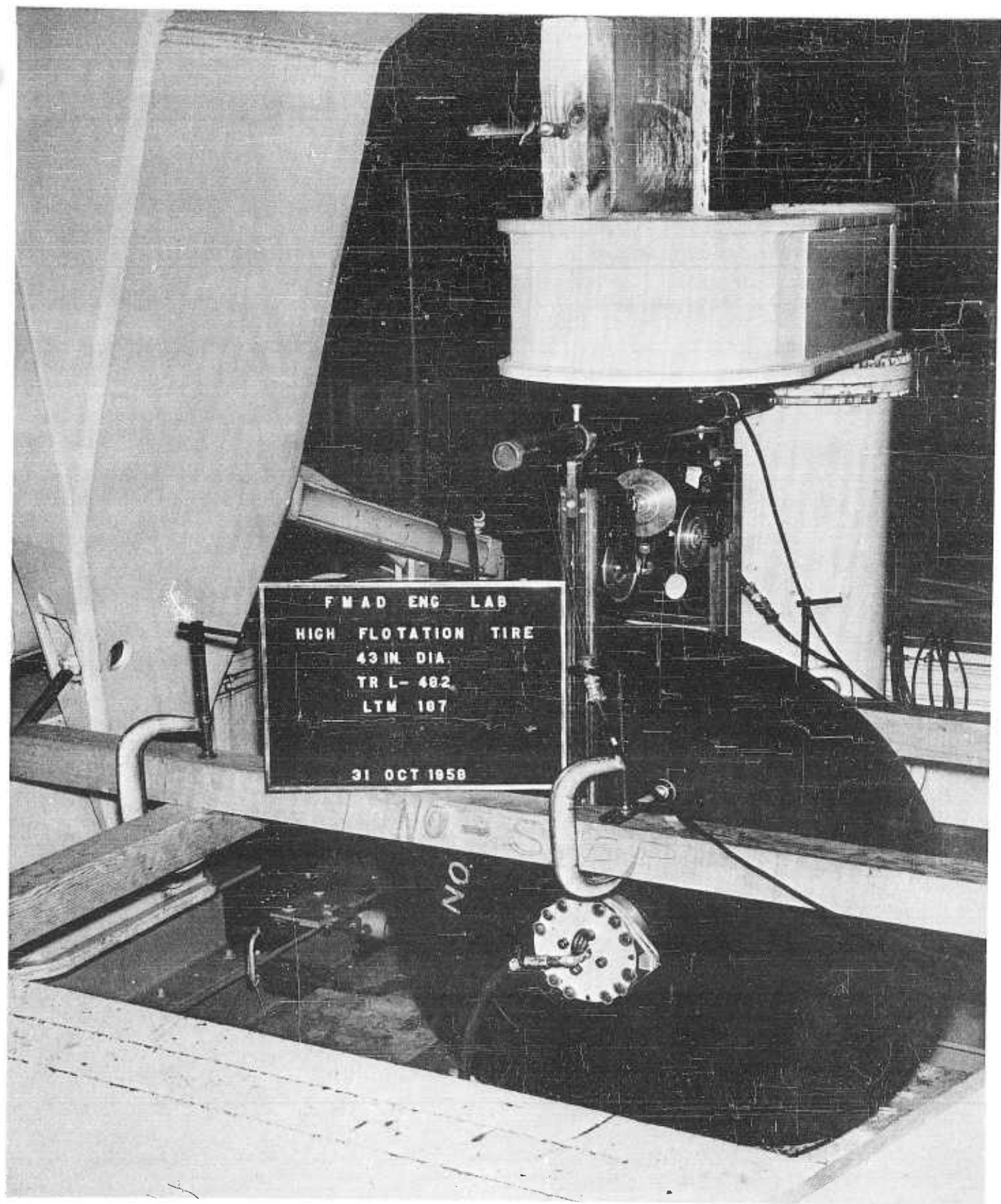












ENGINEERING REPORT NO.

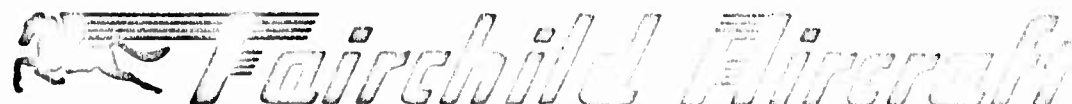
R245-011

SUBJECT

ROLLING TESTS

HIGH-FLOTATION TIRE

MODEL: M-245



DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION HAGERSTOWN 10, MARYLAND

Date of Test: 1-22-59 to 3-9-59

Tested by: B.R. Klein

DATE: April 17, 1959

NO. PAGES: 46

PREPARED BY: B.R. Klein
B.R. Klein

APPROVED BY: J.N. Marsden
J.N. Marsden
Assistant Manager, Tech. Testing

CHECKED BY: R.R. Enterline
R.R. Enterline

APPROVED BY: E.E. Morton
E.E. Morton
Manager, Tech. Design & Analysis

APPROVED: V. Frisby
Project - V. Frisby

REVISIONS

DATE	PAGES AFFECTED	BY	REMARKS
4/21/59	Pg.9 Revised, Pg. 9a added.	R.Enterline	

REPORT NO.	R245-011		FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION	PAGES	PAGE 1
MODEL	M-245	PREPARED BY B.R. Klein	CHECKED BY R.R. Rutherford	APPROVED BY J. H. Barton/Frisby	
SUBJECT:- Rolling Test - High Flotation Tire.				DATE	April 13, 1959
				REVISED	

ABSTRACT

Rolling tests were conducted on a tire to determine rolling resistance on smooth pavement, reaction to simulated rough terrain, cornering, camber angle, braking, lateral stability, and shimmying tendencies. The test specimen was a 43" diameter high flotation tire, rated at 1500#, with 60° cord cross-over developed by FAMD under contract with TRECOM. Oscillograph records were made of all tests and moving pictures were taken of some runs at each phase of testing.

The test rig consisted of an open rectangular base mounted on truck wheels, located at the rear of the base, and a raised platform at the front or tow end on which was mounted a three sided instrumentation and personnel shelter. This rig was towed by a highway type tractor. The basic rig was the same as used for the static tests and described in FAMD Report No. R245-010.

The rolling resistance phase of the tests consisted of applying a 1500# vertical load through the axle and tire at each of the initial tire pressures of 4, 8, 12, 16 and 24 psi., and making runs up to 40 MPH on smooth pavement.

The simulated rough terrain phase of the tests consisted of rolling, at various speeds, over obstacles and across a ditch which simulated ruts, bumps, and pot holes respectively. The height and spacing of obstacles and depth of the ditch were changed for different tests. Vertical loads of 1500#, 3000#, and 4500# were applied at initial tire pressures of 4, 12 and 24 psi.

The smooth pavement cornering phase of the tests consisted of setting the axle at a 15° caster angle and making a 0-15 MPH run on smooth pavement. Loads of 1000# and 1500# were applied at initial tire pressures of 4 and 24 psi.

The camber angle phase of the tests consisted of setting the normally vertical axis of the strut at a 15° angle from the vertical and making a run of 0-40-0 MPH on smooth pavement. Runs were made with 1500#, 3000#, and 4500# loads applied at initial tire pressures of 12, 20 and 24 psi.

The last phase of testing was the braking, lateral stability, and shimmying tendencies on smooth pavement tests. This consisted of making 0-40-0 MPH runs on smooth pavement and 'steering' the tire so as to try to induce shimmy. The high flotation tire brake was applied on the deceleration part of these tests.

Oscillograph records were made of every run and the tabulated data and graphs are presented in the Appendix of this report.

The tire withstood all phases of testing with no apparent damage except in the cornering tests when the lack of tread-stock on this tire resulted in surface-wear exposing the cording.

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MODEL M-245	PREPARED BY B.R. Klein	CHECKED BY R.R. Enterline	APPROVED BY Paraden/Lorton/Frisby		
SUBJECT:- Rolling Test - High Flotation Tire.			DATE April 13, 1959		
			REVISED		

ADMINISTRATIVE DATA

PURPOSE:

As specifically authorized by contract DA44-177-TC-446, the purpose of this test on a high-flotation tire was as follows:

- (a) Determination of rolling resistance of the high-flotation, prototype flight test model tire on smooth pavement through the practical range of inflation pressures and ranges of deflection for speeds from 0 to the limits imposed by the available test vehicle, but not to exceed 115 feet per second.
- (b) Determination of behavior of flight test model tires at 100, 200, 300 per centum rated load as regards cornering, braking, lateral stability and shimmying tendencies, while rolling upon smooth pavements at speeds from 0 to the limits imposed by the available test vehicles, but not to exceed 115 feet per second.
- (c) Determination of behavior of flight test model tires, to include reaction forces generated from encountering various ruts, bumps, pot-holes, etc., at speeds from 0 to limits imposed by the available test vehicle, but not to exceed 115 feet per second and with supported loads up to 300 percent rated load or as limited by bottoming or tire wrinkling.

MANUFACTURER:

Fairchild Aircraft and Missiles Division
Hagerstown, Maryland

MANUFACTURER'S TYPE OR MODEL NO.:

High-Flotation Tire Serial No. 15 rated at 1500# - 43" diameter,
60° cross-over angle of cord winding.

DRAWINGS, SPECIFICATIONS, EXHIBITS:

Contract No. DA44-177-TC-446
FAMD Report R245-010
Wilson Nuttall Raimond Drawing No. 41-9
(Copies may be obtained on request to FAMD)

QUANTITY OF ITEMS TESTED:

One

REPORT NO. R245-011		FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION		PAGES	PAGE 3
MODEL M-245	PREPARED BY B.R. Klein	CHECKED BY R.R. Enterline	APPROVED BY Marsden/Morton/Frisby		
SUBJECT:- Rolling Test - High Flotation Tire.			DATE April 13, 1959		
			REVISED		
<u>ADMINISTRATIVE DATA (continued)</u>					
SECURITY CLASSIFICATION OF ITEM:					
Unclassified					
DATE TEST COMPLETED:					
March 9, 1959					
TEST CONDUCTED BY:					
B.R. Klein FAMD, Engineering Laboratory					
DISPOSITION OF SPECIMEN:					
Held pending disposition notice from TRECOM.					

REPORT NO. R245-011		FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION		PAGES	PAGE 1
MODEL M-245	PREPARED BY B.R. Klein	CHECKED BY R.R. Esterline	APPROVED BY RST/G-1/Morton/Frisby		
SUBJECT:- Rolling Test - High Flotation Tire.			DATE April 13, 1959		
			REVISED		

FACTUAL DATA

DESCRIPTION OF TEST APPARATUS:

The test apparatus used in the rolling tests of the high-flotation tire consisted of a heavy steel truck trailer type rig designed by Wilson, Nuttall and Raimond (reference drawing No. 41-9) and manufactured by Thompson Equipment Machine Company. This rig was towed by a highway type truck tractor. The set-up is illustrated in photographs no. 38948 39013 and 39011 in the Appendix.

This rig was basically the same as used on the static test and described in FAMD Report R245-010. A three sided instrumentation and personnel shelter was mounted on the raised platform at the front or tow end of the rig. A multichannel C.E.C. oscillograph and amplifiers were mounted in this shelter.

Electrical power was supplied by an engine-driven generator, 28 volt D.C. 70 amp. capacity. A moving picture camera was mounted a few feet in front of the tire to obtain regular and slow motion pictures of the tire during testing. Seats were installed in the shelter for an oscillograph operator and an observer.

A foot brake system for the high flotation tire was installed under the instrument table, and was operated by the oscillograph operator when braking data was desired. A wheel was installed at the rear of the rig which was instrumented to record the direction and speed of the rig on the oscillograph. Compressed air bottles were mounted on the side of the rig for changing the tire pressure and operating the vertical-load cylinder. However, after about two thirds of the test program was completed, excessive air leakage in the cylinder prompted a change to oil operation.

Deflection and turning of the strut were measured by helipots, reference photograph no. 39012 in the Appendix. All of the deflection measuring devices, the 6 channel strut dynamometer and the helipots, were recorded on the C.E.C. oscillograph. Strain gages had been installed and calibrated on the dynamometer during the static test program using laboratory load cells.

The obstacles used in the rough terrain tests were as follows: obstacles simulating ruts and bumps were installed singly and in series at spacings of 4 to 16 feet. A 2 x 10 board was anchored to the runway and other boards fastened to it to change the obstacle height. These obstacles may be seen in photograph 38971. A pothole was simulated by making a ditch with plywood sides to prevent crumbling of the edges. The ditch was 24 inches wide by 40 inches long. The depth of the ditch was varied from 12 to 4 inches by adding or removing boards. The ditch is shown in photograph no. 38970.

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MODEL M-245	PREPARED BY B.R. Klein	CHECKED BY R.R. Enterline	APPROVED BY Harrison/Morton/Frisby		
SUBJECT:- Rolling Test - High Flotation Tire.				DATE	April 13, 1959
				REVISED	

FACTUAL DATA (continued)

TEST PROCEDURE:

ROLLING RESISTANCE TESTS-

At an initial tire pressure of 4 psi, a vertical load of 1500# was applied to the tire and a run made from 0-40-0 MPH. An oscillograph record was taken during the entire run. This procedure was repeated at 8, 12, 16 and 24 psi initial tire pressures. The high flotation tire brake was applied during the deceleration of some of these runs.

SMOOTH PAVEMENT, BRAKING, LATERAL STABILITY & SHIMMYING TENDENCIES TESTS-

These tests were conducted by "Steering" the tire from neutral to 5 or 10 degrees in each direction during a 0-40-0 MPH run. This was done to try to induce shimmy. The brake on the high flotation tire was applied during deceleration on those runs. Tests were run at 4, 12 and 24 psi tire pressure. At 4 psi, loads of 1000# and 1500# were applied at 12 and 24 psi, loads of 1000#, 1500#, 3000# and 4500# were applied. Oscillograph records were taken during all runs.

SIMULATED ROUGH TERRAIN TESTS (RUTS AND BUMPS)-

These tests were conducted by running the tire over wooden obstacles simulating bumps. Two obstacles were used, varying in height from 2" to 10" and in spacing from 4 to 16 feet. Tests were run at 4 psi initial tire pressure with 1500# vertical load applied and at 12 and 24 psi with loads of 1500#, 3000# and 4500#. The height of the obstacles was increased at each tire pressure and load until it was considered unsafe for the tire or for axle clearance. Oscillograph records were taken and a blip was put on the record as the tire hit the obstacles.

SIMULATED ROUGH TERRAIN (DITCH)-

These tests were conducted by running the tire over the ditch at the various loads and tire pressures. Three different ditch depths were used, 4, 8 and 12 inches, until it was concluded that the depth had little or no effect on the tire. This was due to the fact that oil, used to raise and power the vertical load cylinder, hydraulically locked the cylinder in place, thus preventing the tire from dropping into the ditch. It should be noted here that the cylinder did not move vertically, even when air was used in the system while conducting the tests over obstacles and therefore the change to oil had little effect on the results of this test.

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MODEL M-245	PREPARED BY	CHECKED BY	APPROVED BY		
SUBJECT:- Rolling Test - High Flotation Tire.				DATE	
				REVISED	

FACTUAL DATA (continued)

TEST PROCEDURE:

SIMULATED ROUGH TERRAIN (DITCH)- (continued)

Tests were run at the identical tire pressures and loads used in the tests over the obstacles simulating ruts and bumps. Oscillograph records were taken during each run.

CAMBER ANGLE TESTS-

These tests were conducted by rotating the large U-shaped yoke on the rig to the desired camber angle. The first angle tried was 25°. However, it was found after one run, that at this angle the friction in the cylinder and excessive leakage past the piston prevented raising the tire. It was also found that there was interference at this angle between the brake drum and the side of the rig at the higher loads. Therefore all of these tests were run at 15° camber angle. Since at this angle the tire wrinkled to excess at any appreciable load at 4 psi tire pressure, tests were run only at 12, 20 and 24 psi tire pressure. At 12 psi, loads of 1500# and 3000# were applied and at 20 and 24 psi initial tire pressure, loads of 1500#, 3000# and 4500# were applied. The test consisted of a 0-40-0 MPH run on smooth pavement. Oscillograph records were taken.

SMOOTH PAVEMENT CORNERING-

These tests were conducted by rotating the axle to a 15° caster angle and making a run on smooth pavement at a speed considered safe for the tire. In this case the runs were made at speeds up to 15 MPH. Due to the large amount of rubber taken off the tire in these tests, runs were made only at 1000# and 1500# at tire pressures of 4 and 24 psi. Oscillograph records were made during entire run.

In every phase of testing, a representative number of moving pictures were taken, at different tire pressures, loads and test conditions.

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SUBJECT:- Rolling Test - High Flotation Tire				DATE	
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FACTUAL DATA (continued)

RESULTS OF TEST:

Dynamometer cross channel response was determined by investigating static test calibration runs. It was determined that the only loading condition that affected other channels was vertical loading which caused some response in the side, drag moment, and torque bridges. The amount of this response is tabulated on page 12.

Overall calibration accuracy of the dynamometer was within $\pm 2\%$ of full range. The oscillograph records can be read to within $\pm 1\%$ accuracy for 1 inch of trace deflection. Before each group of test runs, calibration runs were corrected for any change in voltage that occurred.

It is estimated that the overall accuracy of the plotted data are within $\pm 4\%$.

The high flotation tire withstood all phases of testing with no noticeable permanent distortion. Considerable wearing of the tire surface occurred during the caster angle and the "steering" tests. The condition of the tire after this type of test may be seen in photo. no. 38911. The lack of tread-stock on this tire is primarily responsible for this result.

Curves plotted from all tests, except the rough terrain tests, show that speed had no effect on any of the reactions. The brake was applied on the deceleration part of some of these runs but the brake was inadequate for this system and therefore the data for this phase were inadequate.

On some of the curves negative drag was indicated. This may be explained by the fact that the top of the dynamometer was slightly aft of its theoretically vertical position due to the position of the rig when attached to the tractor. This was reduced later in the test program by changing the rear axle height of the rig.

Curves plotted from rolling resistance tests on smooth pavement show that there was a maximum drag load of 0.5% of the vertical load and the maximum indicated side load was 30% of the vertical. Part of this side load reading was caused by the dynamometer cross channel influence (see pg.12) and the fact that the wheel position was found to be $\frac{1}{2}^\circ$ off the true fore and aft position.

Efforts to induce shimmy in the tire by "steering" were unsuccessful. All the runs in this phase were run while steering the tire from 0° to 10° in each direction and vertical, drag, and drag moment loads increased or decreased in unison with the side loads and the steering angle as can be seen on the plotted curves of these tests.

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MODFL. M-245	PREPARED BY	CHECKED BY	APPROVED BY		
SUBJECT:- Rolling Test - High Flotation Tire			DATE		
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FACTUAL DATA (continued)

RESULTS OF TEST:

Tabulations were made to show the effect of tire pressure on drag versus vertical loads and may be found on page 15. Curves were plotted to show the effect of obstacle height and tire pressure on vertical loads during rough terrain tests, and may be found on pages 16 - 18.

Curves plotted from camber angle tests show a negative drag load at all vertical loads. However, these loads are very close to the instrumentation accuracy and can therefore be considered negligible. The side load varied from 25% of vertical load to 70% of vertical load.

Curves plotted from caster angle tests show that drag load can again be considered negligible. During these runs the ratio of side load to vertical load reached a maximum of approximately four times the vertical load.

Variation in vertical load during an individual run was due to unevenness of the pavement on the runway on which the tests were made.

TEST DATA:

Data submitted in the Appendix.

RECOMMENDATIONS:

It is recommended that if any additional testing is to be done with this rig the friction in the vertical strut should be reduced in order to permit vertical motion and thereby simulate actual reactions during rough terrain tests. Ideally, this action should be provided by an "A" frame parallelogram mounting.

It is further recommended that this type of tire be approved for tests on aircraft up to its rated load of 1500#, as it completed all phases of this testing with no difficulty or signs of failure.

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MODEL M-245	PREPARED BY B.R. Klein	CHECKED BY R.R. Enterline	APPROVED BY Sarsden/Barton/Feisby		
SUBJECT:- Rolling Test - High Flotation Tire.			DATE April 17, 1959		
			REVISED April 21, 1959		

APPENDIX

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MODEL	M-245	PREPARED BY	B.R. Klein	CHECKED BY	R.R. Enterline	APPROVED BY Marsden/Morton/Frisby
SUBJECT:- Rolling Test - High Flotation Tire.					DATE	April 21, 1959
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APPENDIX (continued)

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MODEL 15-245	PREPARED BY	CHECKED BY	APPROVED BY		
SUBJECT:- Rolling Test - High Flotation Tire.			DATE		
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APPENDIX

LIST OF PHOTOGRAPHS:

<u>Number</u>	<u>Title</u>
38911	Condition of tire after steering test.
38948	Test rig and tractor.
38970	Ditch simulating pot hole.
38971	Obstacles simulating ruts and bumps.
39011	Control Panel.
39012	Turn Indicator Helipot.
39013	Tire and Strut.

REPORT NO. R245-911		FAIRCHILD AIRCRAFT DIVISION		PAGES	PAGE 11
MODEL M-245		OF FAIRCHILD ENGINE & AIRPLANE CORPORATION			
PREPARED BY		CHECKED BY		APPROVED BY	
SUBJECT:- Rolling Test - High Flotation Tire.				DATE _____	
				REVISED _____	

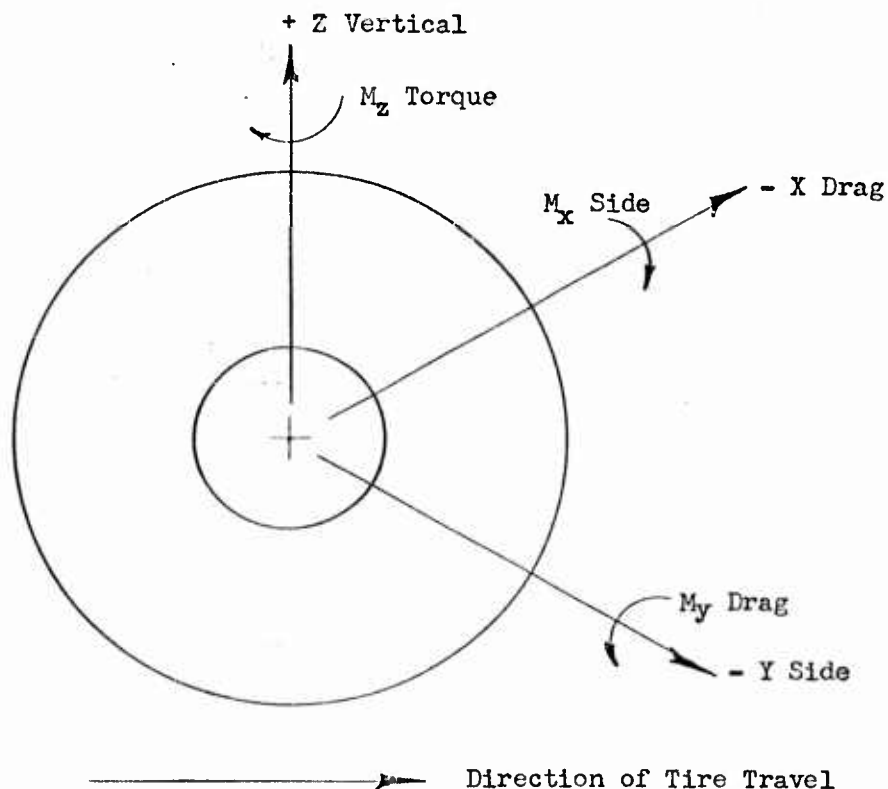
APPENDIX

LOG OF TEST:

Date

12-22-58	Received test request and folder.
1-13-59	Completed FAMD Drawing TM-327
1-16-59	Completed test procedure.
1-22-59	Made two smooth pavement runs.
2-2-59	Made two smooth pavement runs. Axle seized tight. Discovered damaged spacer on axle. Spacer removed and hub relocated with set screws.
2-5-59	Made two smooth pavement runs and 17 runs over obstacles.
2-6-59	Made three runs over obstacles. Axle started to work out of hub. Added additional set screw with locating hole in axle.
2-12-59	Made fifteen runs - smooth pavement and obstacle.
2-13-59	Made fourteen runs over obstacles.
2-17-59	Made three runs over obstacles. Truck hit obstacles on third run - broke obstacles.
2-19-59	Made one run on smooth pavement at 25° camber angle. Couldn't raise the tire after run with side of rig. Reduced angle to 15° for future runs.
2-24-59	Made eight runs at 15° camber angle at 0-40-0 MPH.
2-25-59	Made ten runs "steering" the tire.
3-2-59	Made thirteen runs over ditch and two runs over 8" obstacle for film purposes.
3-3-59	Made five runs steering the tire and two runs at 15° caster angle.
3-9-59	Made two runs on dirt and made three smooth pavement runs at 15° caster angle.

REPORT NO. R245-011			FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION		PAGES	PAGE 12
MODEL	PREPARED BY	CHECKED BY			APPROVED BY	
SUBJECT:- High Flotation Tire - Rolling Tests.					DATE _____	
					REVISED _____	



DYNAMOMETER CROSS CHANNEL RESPONSE

Applied Load	Vertical	Side	Drag	M_y (Drag)	M_x (Side)	M_z (Torque)
Vertical	1.0	-41#/1000#	0	-270"/1000#	0	+590"/1000#
Side	0	1.0	0	0	0	0
Drag	0	0	1.0	0	0	0
M_y (Drag)	0	0	0	1.0	0	0
M_x (Side)	0	0	0	0	0*	0
M_z (Torque)	0	0	0	0	0	1.0
Accuracy of Readings	$\pm 70\#$	$\pm 30\#$	$\pm 30\#$	$\pm 400\#$		$\pm 1000\#$

* The side moment bridge is so insensitive that no readings were ever noted for this reaction.

STATIC TEST LABORATORY DATA SHEET

FAIRCHILD AIRCRAFT DIVISION

Page 13

PAGE _____ OF _____

PROJECT: High Flotation Tire DATE _____

MODEL: _____ CONDITION: Obstacle Test

TEST NO. _____ TESTED BY: _____

STRESS WITNESS: _____ CUSTOMER INSPECTION: _____

Record No.					Peak Loads Occuring at Obstacles			
	Obstacle Height	Tire Pressure	Vert. Load Lbs.	Act. Vertical Load	Vert. Load Lbs.	Drag Load Lbs.	Side Moment In. Lbs.	Wheel Speed
12192	2"	4	1500	2400	3800	336 -895	-5285	28.6
12195	2"	4	1500	2800	4660	496 -870	-5285	40.1
12246	2"	4	3000	5470	8542	315 -1347	-2610	30.5
12247	2"	4	3000	5470	8817	516 -1081	-2610	19.5
12203	2"	8	1500	2870	5897	280 -1036	-5285	40.1
12204	2"	12	1500	2200	5292	336 -730	-7926	19.6
12206	2"	12	1500	3070	5065	392 -440	-10570	43.0
12218	2"	12	3000	5200	8392	590 -810	-2610	19.1
12219	2"	12	3000	5670	9148	560 -560	-2610	39.1
12207	2"	12	1500	2270	5443	390 -924	-7925	19.1
12208	2"	12	1500	3000	6274	365 -645	-13210	43.0
12220	2"	12	3000	5670	8921	812 -980	+2610	19.8
12201	2"	4	1500	2670	5443	364 -616	+2642	39.6
12209	2"	12	1500	2530	5821	420 -644	-18494	19.1
12210	2"	12	1500	1270	4460	476 -644	-15852	44.4
12248	2"	12	3000	3330	5373	-744	-18270	19.1
12250	2"	12	4500	3070	6338	1005 -1405	-23490	19.1
12249	2"	12	3000	2270	5373	485 -1060	-23490	38.7
12251	2"	12	4500	2600	5857	716 -1115	-26100	40.6
12253	2"	16	1500	270	4684	945 -1175	-36540	33.9
12254	2"	24	1500	4930	10540	746 -831	-41760	19.1

STATIC TEST LABORATORY DATA SHEET

FAIRCHILD AIRCRAFT DIVISION

Page 14

PAGE _____ OF _____

PROJECT: High Flotation Tire DATE: _____

MODEL: _____ CONDITION: Obstacle Test

TEST NO.: _____ TESTED BY: _____

STRESS WITNESS: _____ CUSTOMER INSPECTION: _____

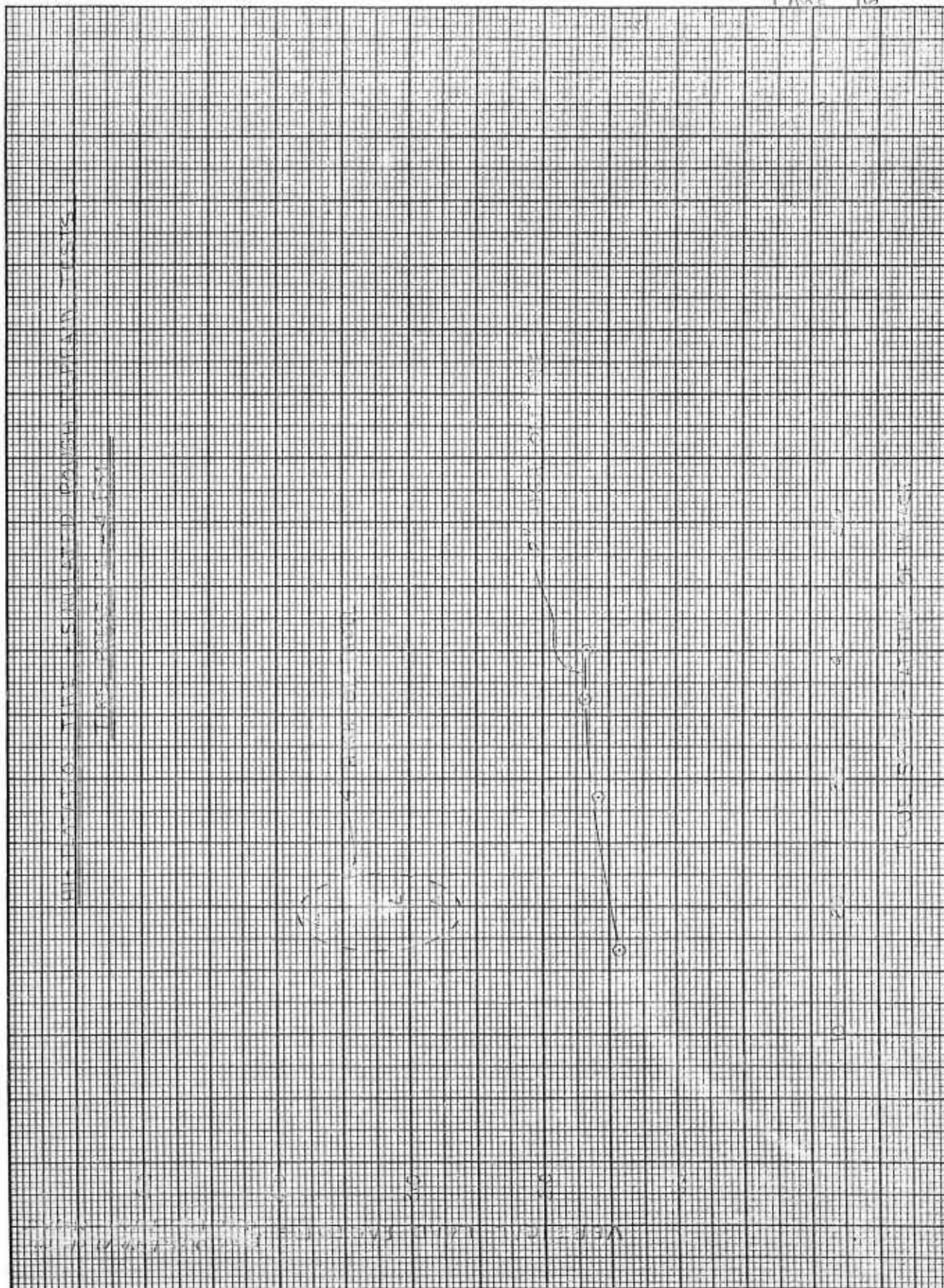
Record No.					Peak Loads Occuring at Obstacles			
	Obstacle Height	Tire Pressure	Vert. Load Lbs.	Act. Vertical Load	Vert. Load Lbs.	Drag Load Lbs.	Side Moment In.Lbs.	Wheel Speed
12255	2"	24	3000	8600	14329	532 -945	-41760	20.5
12256	2"	24	4500	9130	15018	831 -1261	-39150	21.5
12274	4"	4	1500	1730	4800	-960	10440	20.5
12263	4"	24	1500	4400	11573	-1980	23490	16.0
12282	6"	12	1500	1800	8200	620 -1525	18270	20.0
12285	6"	24	1500	1930	11939	1551 -2115	33930	19.6
12280	6"	12	3000	3130	10800	790 -1380	18270	20.2
12281	6"	12	4000	3750	11601	902 -1890	23490	19.6
12372	6"	4	1500	2130	6067	365 -1110	13050	27.9
12276	6"	12	1500	1800	9067	620 -1551	15660	20.2
12277	6"	12	3000	3400	11467	565 -1380	15660	19.3
12278	6"	12	4000	3330	10533	790 -1580	15660	18.6
12433	8"	3	1200	270	3067	620 -935	10760	6.9
12436	8"	3	1200	330	3000	900 -1020	5380	11.5
12428	4" deep	4	1500	1330	800	680 -535	18830	10.5
12437	4" deep	12	1500	3670	133	735 -650	8070	16.0
12431	8" deep	4	1500	1400	933	765 -735	18830	16.0
12432	12" deep	4	1500	3670	1067	765 -1045	10760	*
12440	12" deep	24	1500	1530	400	850 -480	5380	12.9
12241	12" deep	24	3000	2400	400	595 -170	8070	13.2
12442	12" deep	24	4500	3400	133	790 -510	64550	14.8

FAIRCHILD AIRCRAFT DIVISION

PAGE _____ OF _____

STRESS WITNESS: _____ CUSTOMER INSPECTION: _____

[illegible]



HI-COTATION TIRE - SIMULATED ROUGH TERRAIN TESTS

12 PSI TIRE PRESSURE

VERTICAL LOAD FIVE SECONDS
LOAD 1000 LBS. AVAILABLE

1" x 6" HIGH OCS-100
(100)

2" x 6" HIGH OCS-100

TRUE SPEED AT TIME OF HOOK

W- FLOWING FIRE - SIMULATED ROUGH TARGETING TUBE

24 PSI TIRE PKE SK

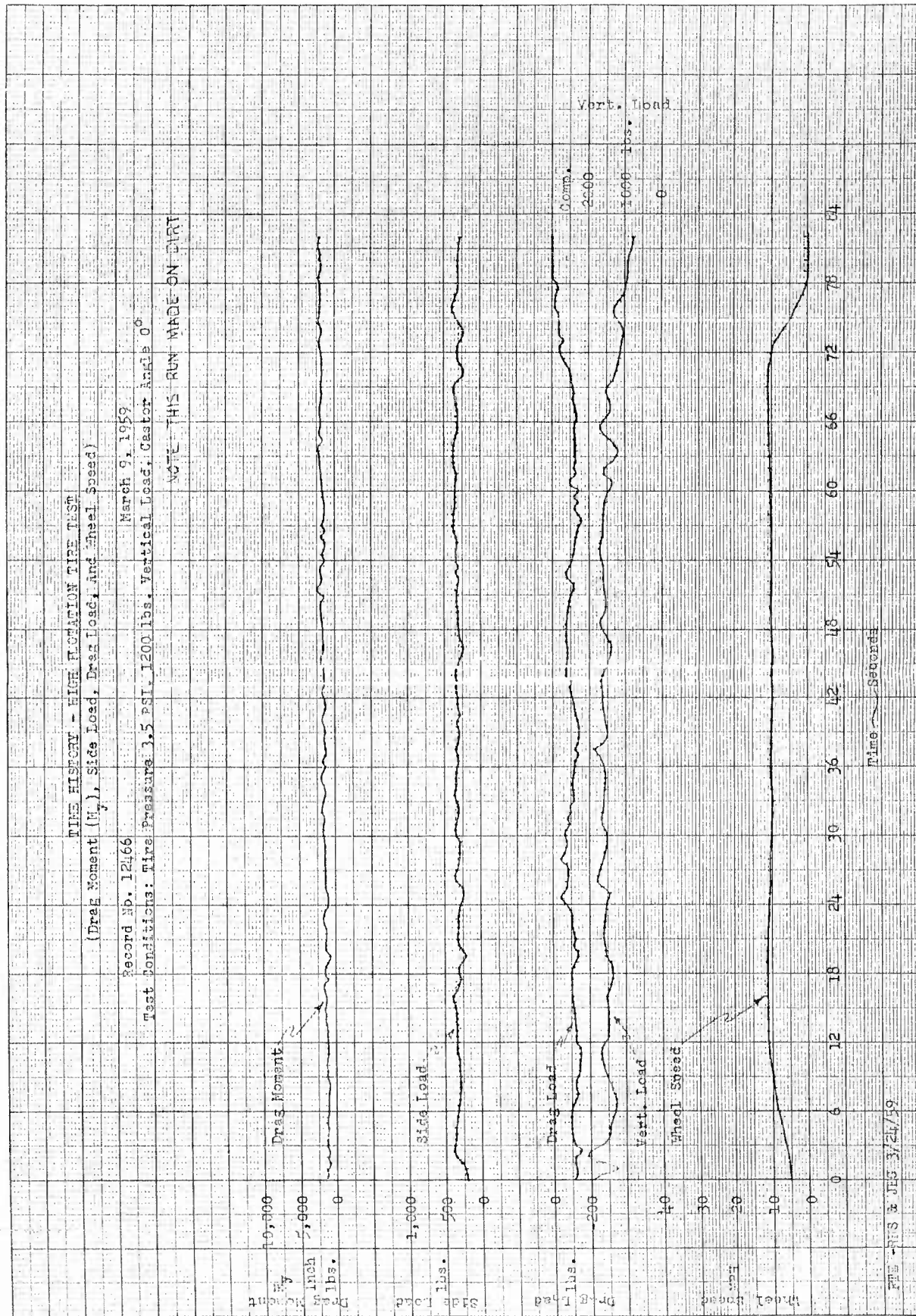
2" HIGH DEBRIS
(RUB ONLY)

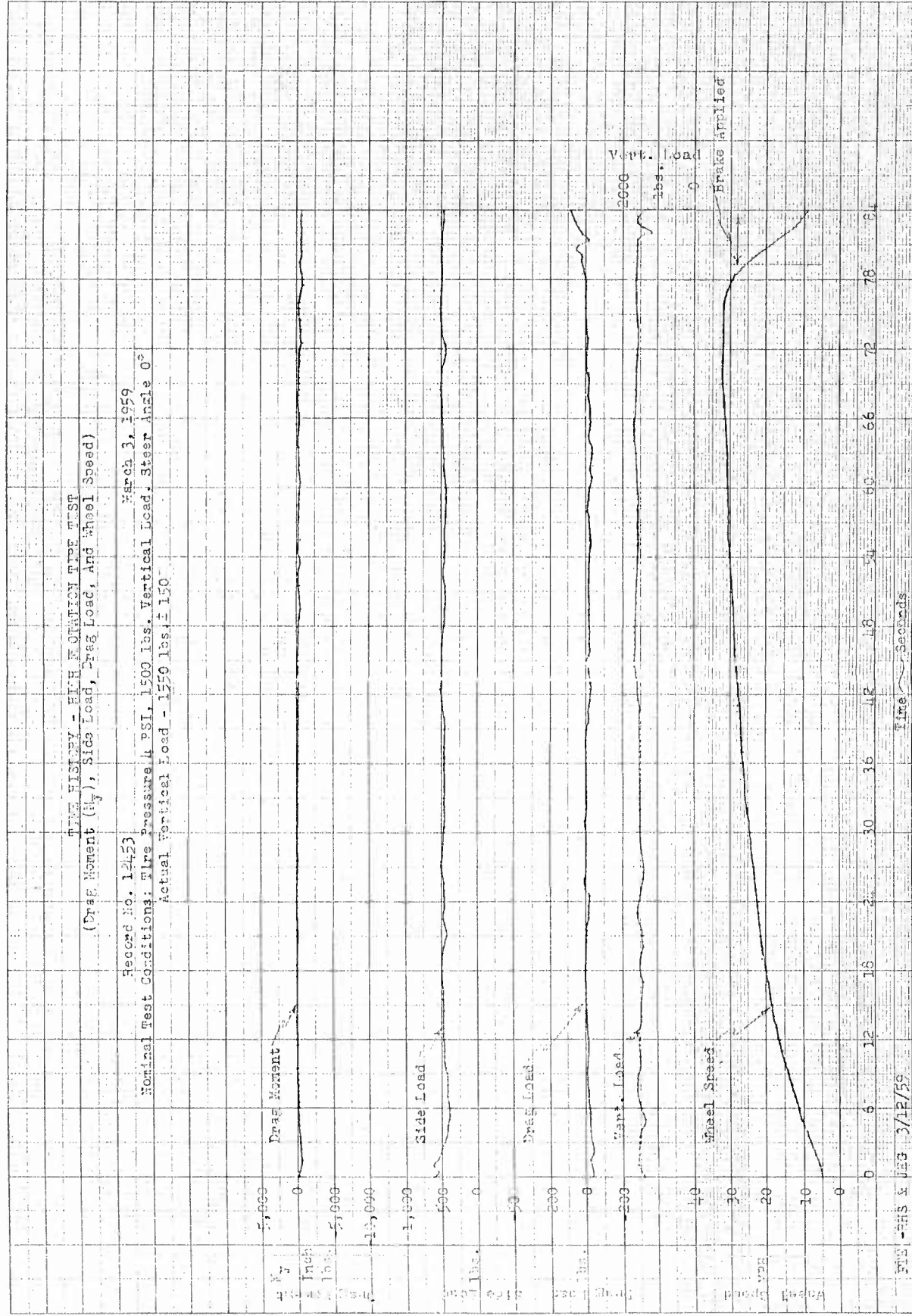
4" HIGH DEBRIS
(RUB ONLY)

2" HIGH DEBRIS
(RUB ONLY)

TRUE SPEED - AT TIME OF IMPACT

1 NOV 10





HIGH FRICTION TIRE TEST

(Vertical Load Vs. Side and Drag Loads)

Record No. 72257

Nominal Test Conditions: Tire Pressure 24 PSI

1500 lbs. Vertical Load

Center Angle 0°

Date 12 Feb. 54

Side Load - lbs.

Drag Load - lbs.

Compression

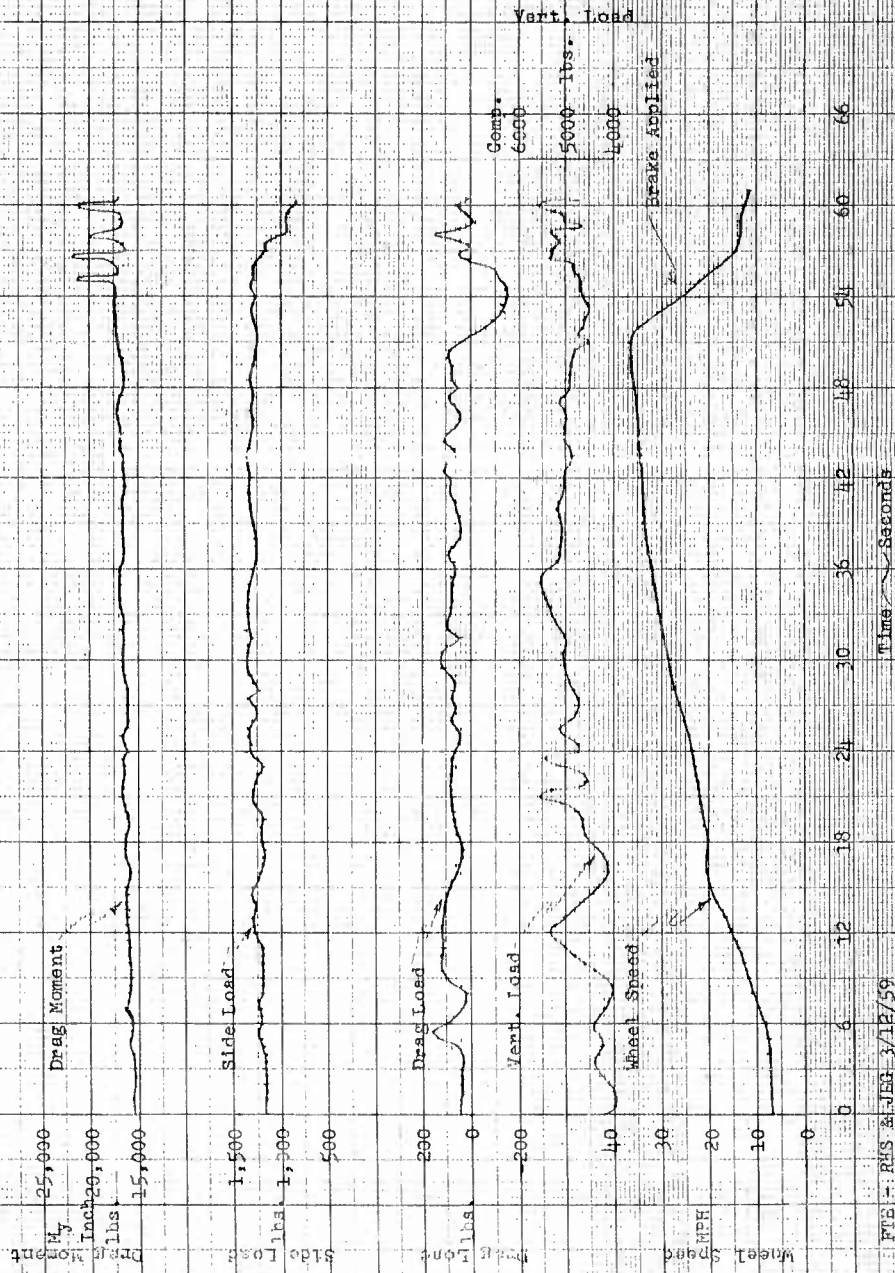
Vertical Load - lbs. X 100

-56 -54 -52 -50 -48 -46 -44 -42 -40 -38 -36 -34 -32 -30 -28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56

Fig. 2

TIME HISTORY - HIGH ROTATION TIRE TEST
(Drag Moment (M_y), Side Load, Drag Load, And Wheel Speed)

Record No. 12257 February 12, 1959
Nominal Test Conditions: Tire Pressure 24 PSI, 1500 lbs. Vertical Load, Camber Angle 0°
Actual Vertical Load - 4860 lbs. ± 700



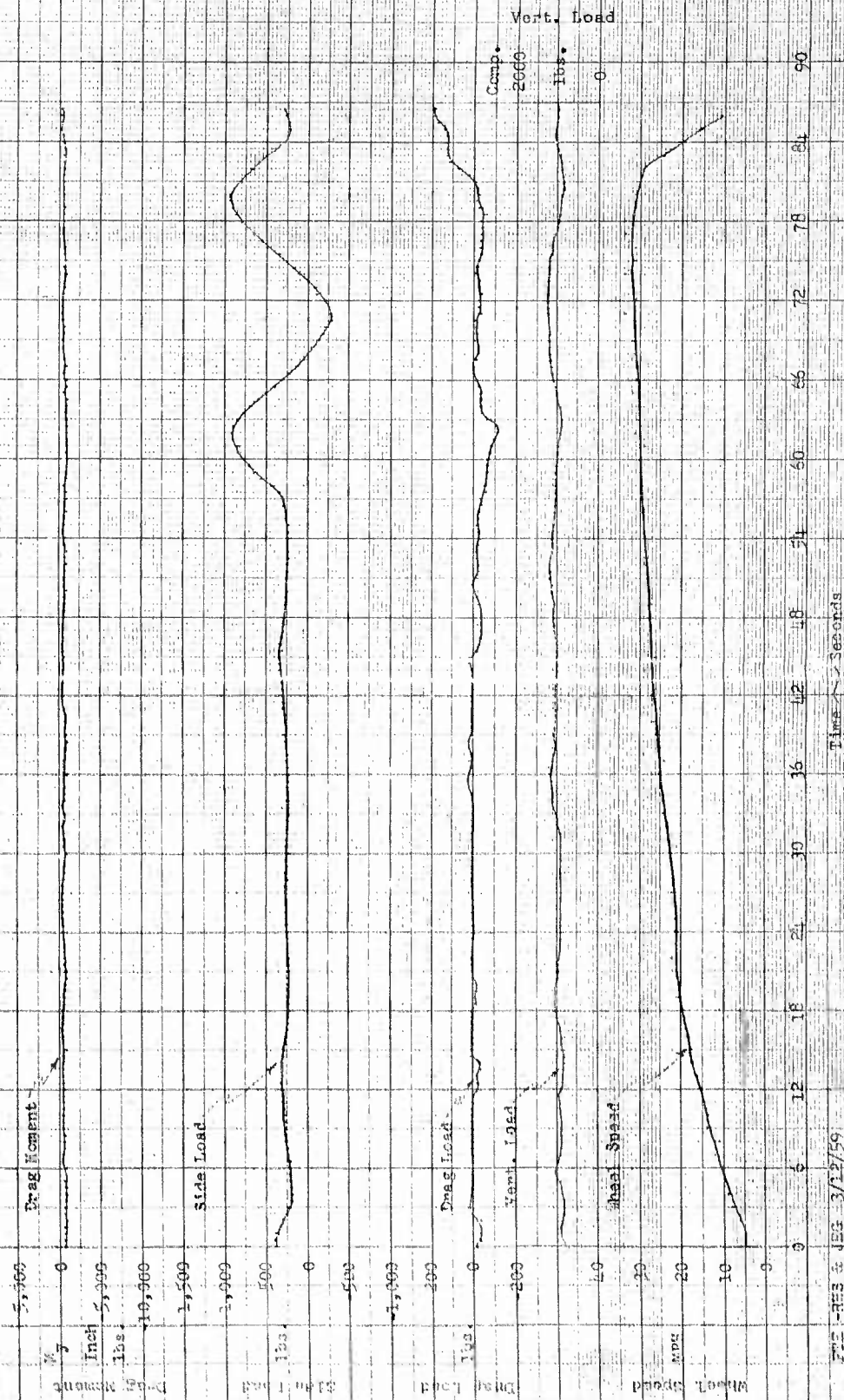
PTB - RUS & JES 3/12/59

TIRE HISTORY - HIGH ROTATION TIRE TEST
(Drag Moment (H_y), Side Load, Drag Load, And Wheel Speed)

Record No. 12451

March 3, 1959

Nominal Test Conditions: Tire Pressure 4 PSI, 1000 lbs. Vertical Load, Steer Angle 10° R-0-10° L
Actual Vertical Load - 1000 lbs. ± 200

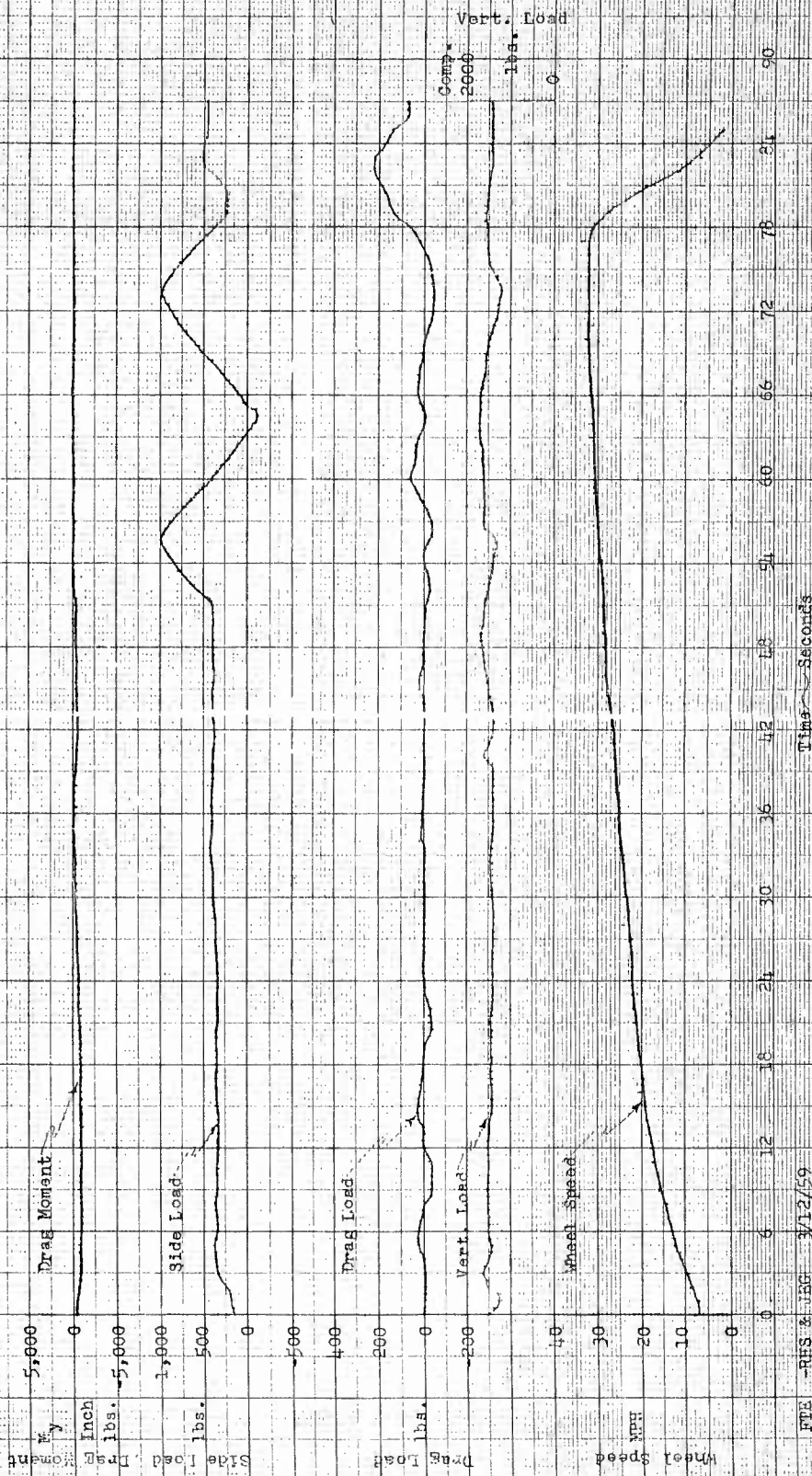


TIME HISTORY - HIGH MOTION TYPE TEST
(Drag Moment (M_y), Side Load, Drag Load, And Wheel Speed)

Record No. 12452

March 3, 1959

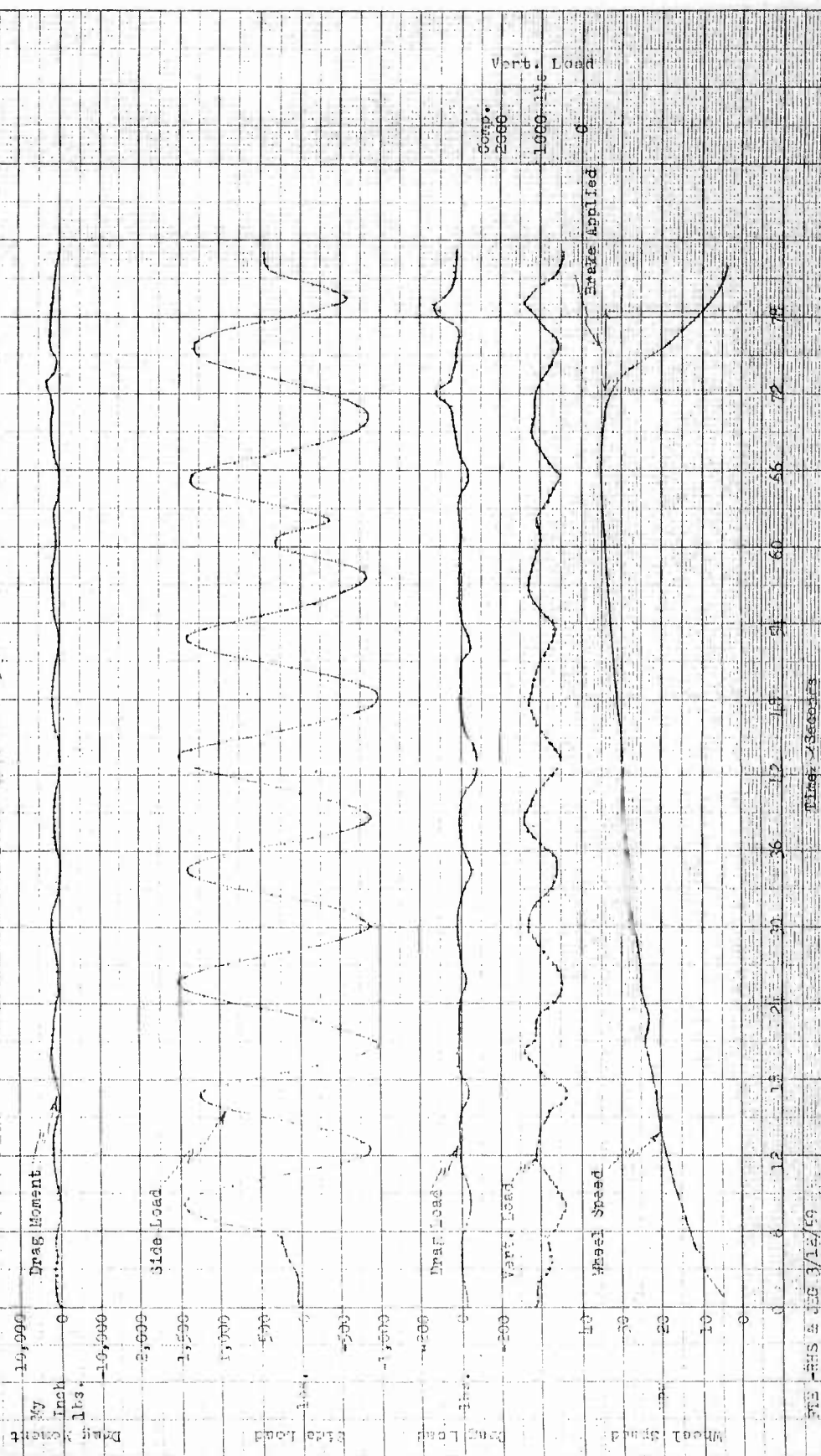
Nominal Test Conditions: Tire Pressure 4 PSI, 1500 lbs. Vertical Load, Steer Angle 10° R-0-10° L
Actual Vertical Load - 1500 lbs. ± 200



TIME HISTORY - HIGH ROTATION TIRE TEST
(Drag Moment (My), Side Load, Drag Load, and Wheel Speed)

Record No. 12403
Nominal Test Conditions: Tire Pressure 12 PSI, 1000 lbs. Vertical Load, Steer Angle 10° H-0-10° L
Actual Vertical Load - 1000 lbs. ± 500

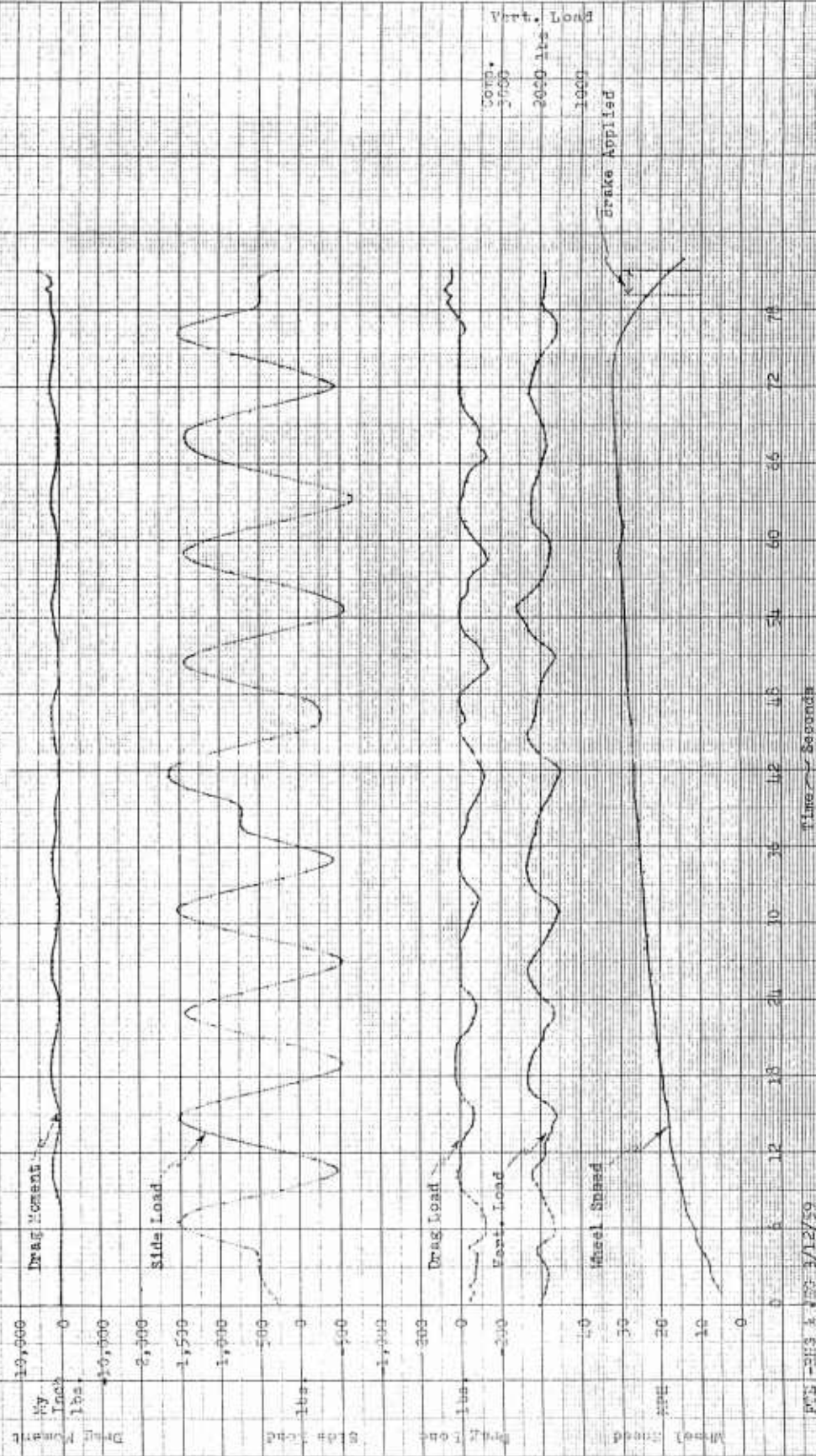
February 25, 1959



MS-2 3/12/59

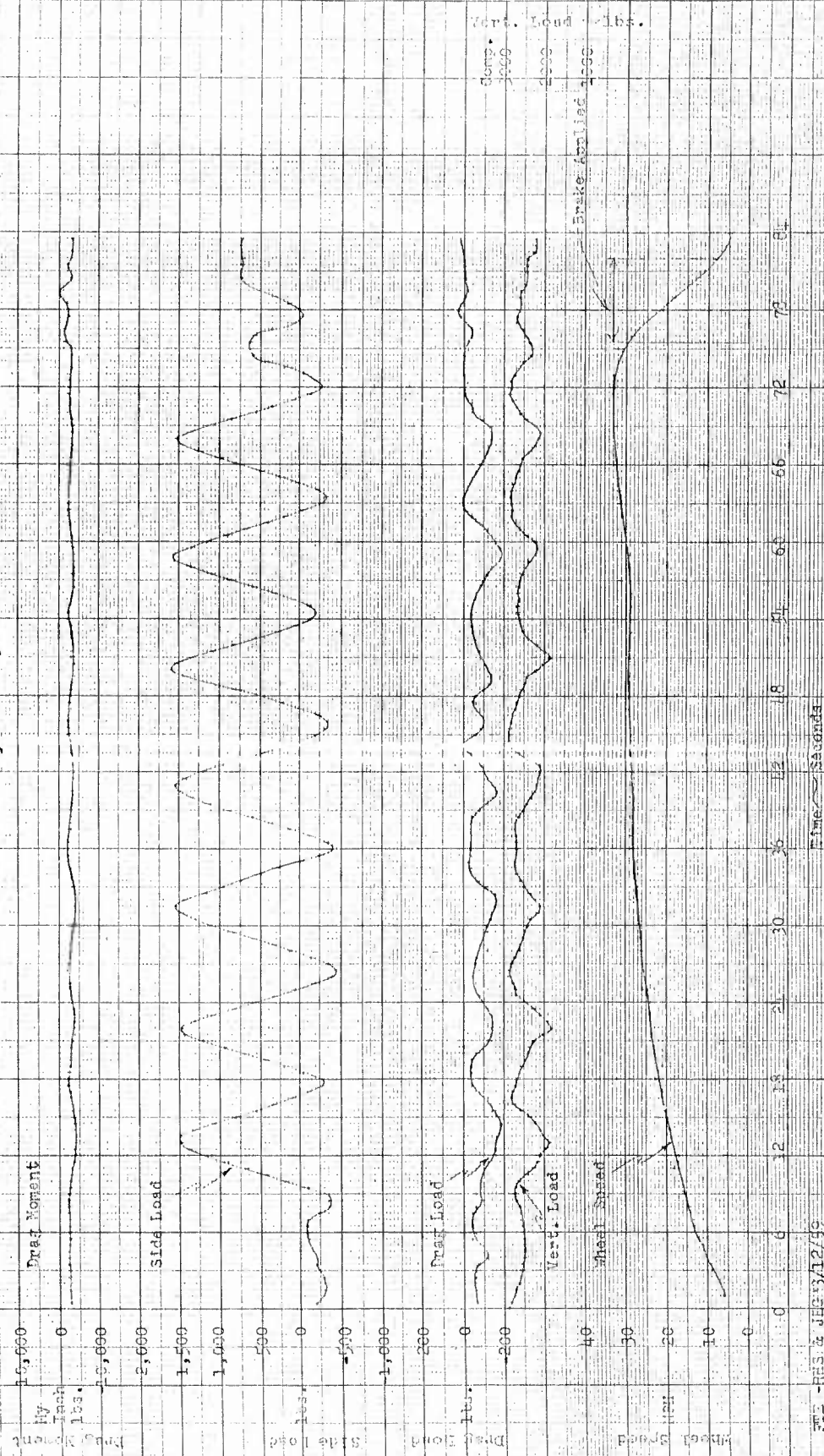
TIRE HISTORY - HIGH ELECTRON TIRE TEST
(Drag Moment (My), Side Load, Drag Load, And Wheel Speed)

Second No. 12409 February 25, 1959
Nominal Test Conditions: Tire Pressure 12 PSI, 1500 lbs. Vertical Load, Steer Angle 10° R-0-10° L
Actual Vertical Load - 2000 lbs. - 500



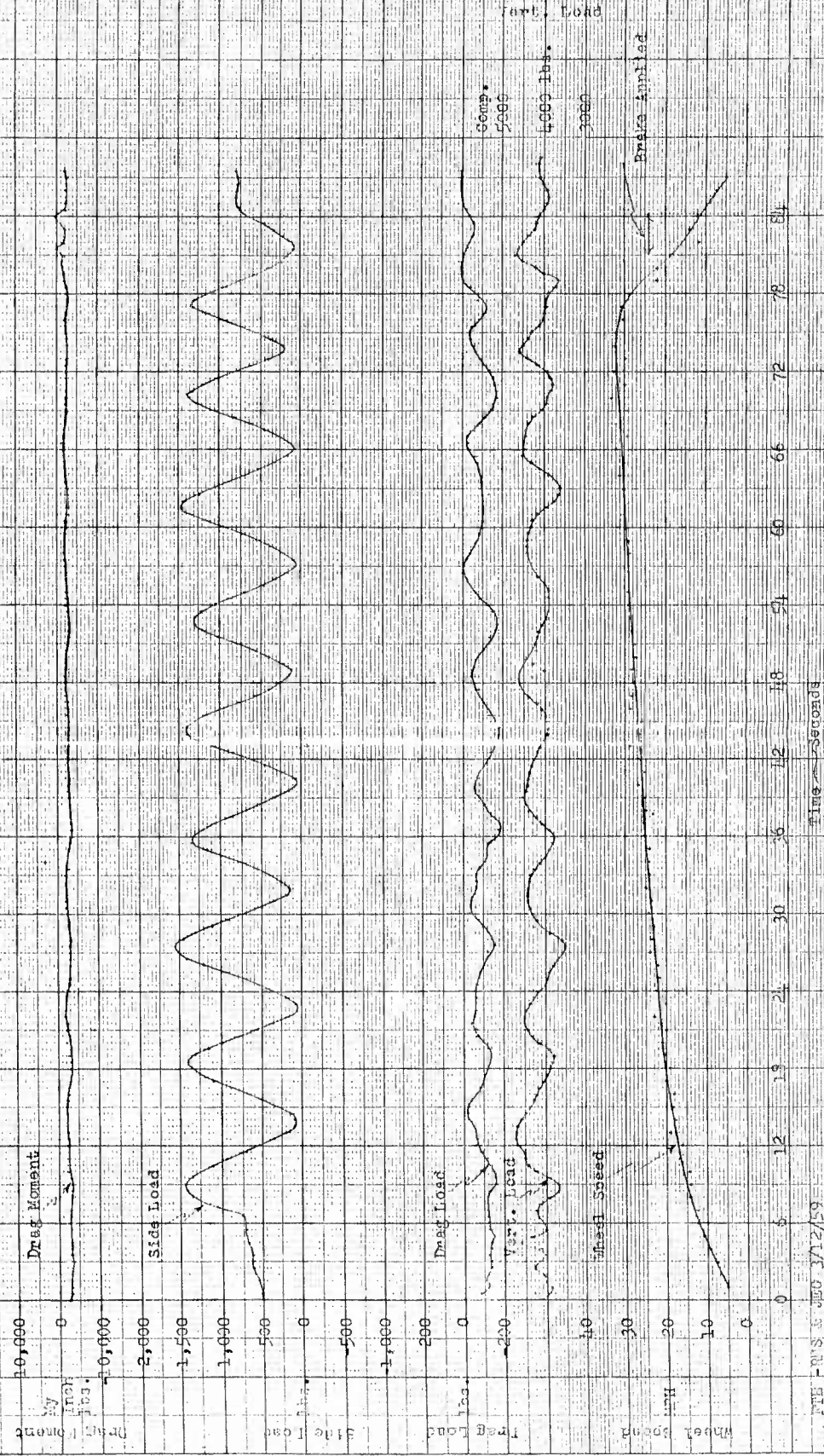
THE HISTORY-HIGH MOTION WIRE TEST
(Drag Moment (Wt.), Side Load, Drag Load, And Wheel Speed)

Record No. 12412
February 25, 1959
Nominal Test Conditions: Tire Pressure 12 PSI, 1000 lbs. Vertical Load, Steer Angle 10°-C-10°L
Actual Vertical Load - 2500 lbs. ± 500



TIME HISTORY - HIGH MOTION TIRE TEST
(Drag Moment (K), Side Load, Drag Load, And Wheel Speed)

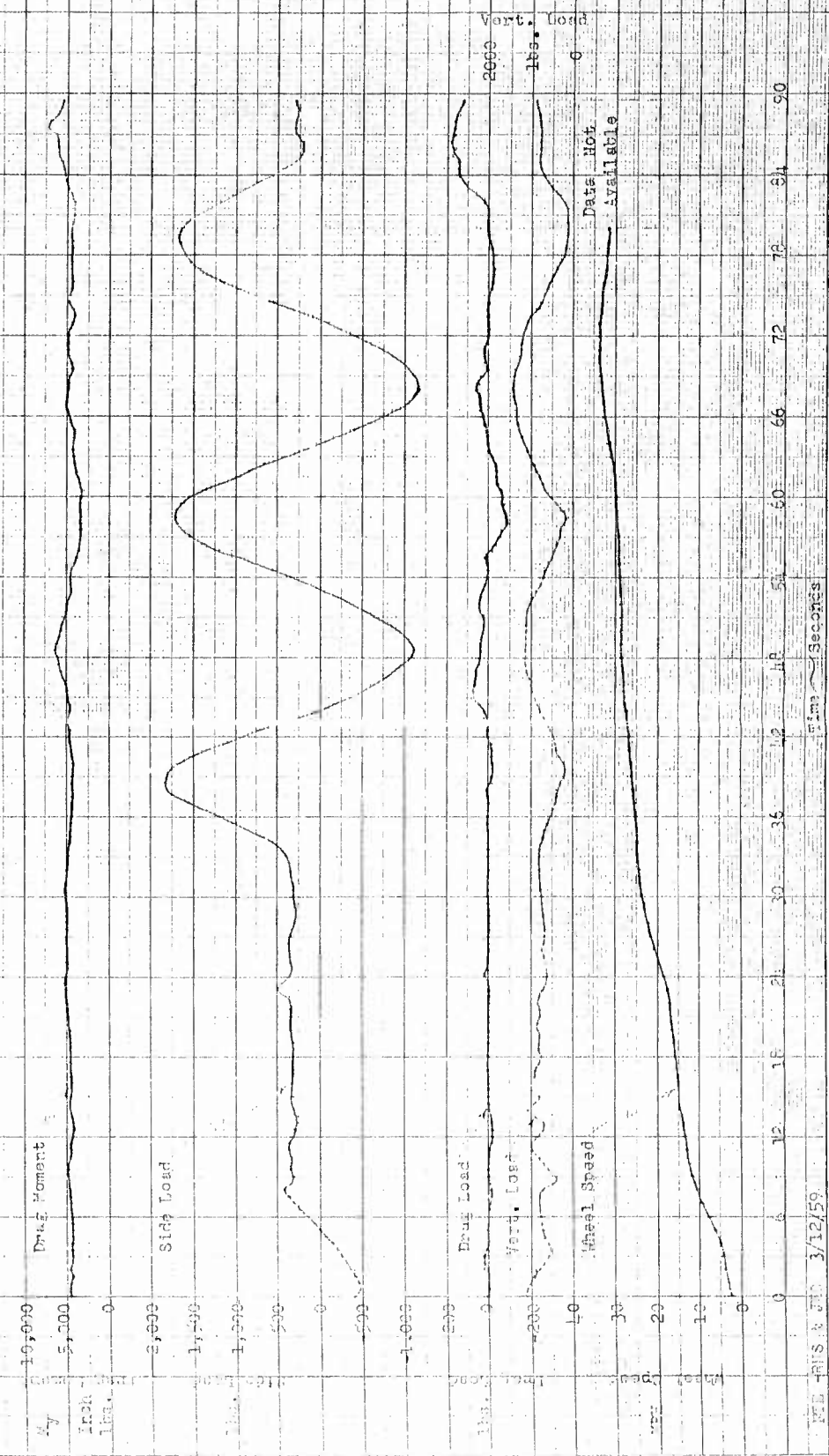
Record No. 12413
February 25, 1959
Nominal Test Conditions: Tire Pressure 12 psi, 4500 lbs. Vertical Load, Steer Angle 10°R-0.10L
Actual Vertical Load - 4200 lbs. ± 500



SA 11

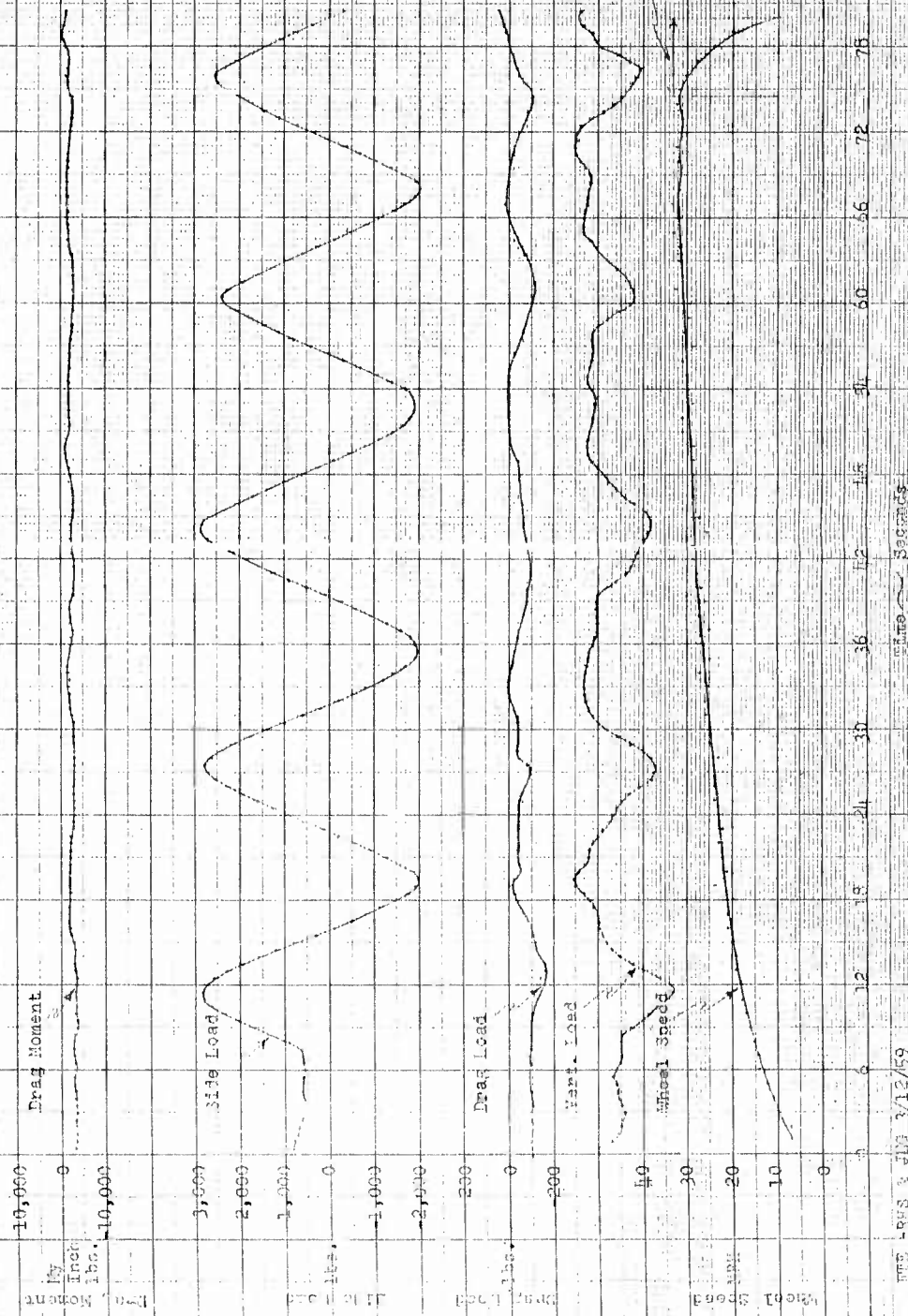
TIME HISTORY - HIGH RESISTANCE TIRE TEST
(Drag Moment (M_y), Side Load, Drag Load, And Wheel Speed)

Record No. 12454
March 3, 1959
Nominal Test Conditions: Tire Pressure 24 PSI, 1500 lbs. Vertical Load, Steer Angle 10°-0-10°
Actual Vertical Load - 1600 lbs. ± 600



TIME HIST. & JTD 3/12/59

Record No. 12417
Nominal Test Conditions: Tire Pressure 24 PSI, 3000 lbs. Vertical Load, Break Angle 10-R-3-10 L
Actual Vertical Load - 1500 lbs. - 1962
February 25, 1959



TIME HISTORY - HIGH MOTION TIRE TEST
(Drag Moment (M_x), Side Load, Drag Load, And Wheel Speed)

Record No. 12455

March 3, 1959

Confined Test Conditions: Tens. Pressure 24 psl, 4500 lbs. Vertical Load, Steel Anchor 100-0-0
Actual Vertical Load - 5500 lbs. 500

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Unit	2000
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| 1998 | 70 |
| 1999 | 75 |
| 2000 | 60 |
| 2001 | 70 |
| 2002 | 75 |
| 2003 | 80 |
| 2004 | 85 |

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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

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| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

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|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

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| 20. $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ | 21. $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ |
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10

MS - 883.2 080 3/12/59

Mr. & Mrs. S. J. S. S. S.

| Temp. | Vert. Land |
|-------|------------|
| 4000 | |
| 3000 | |
| 2000 | |

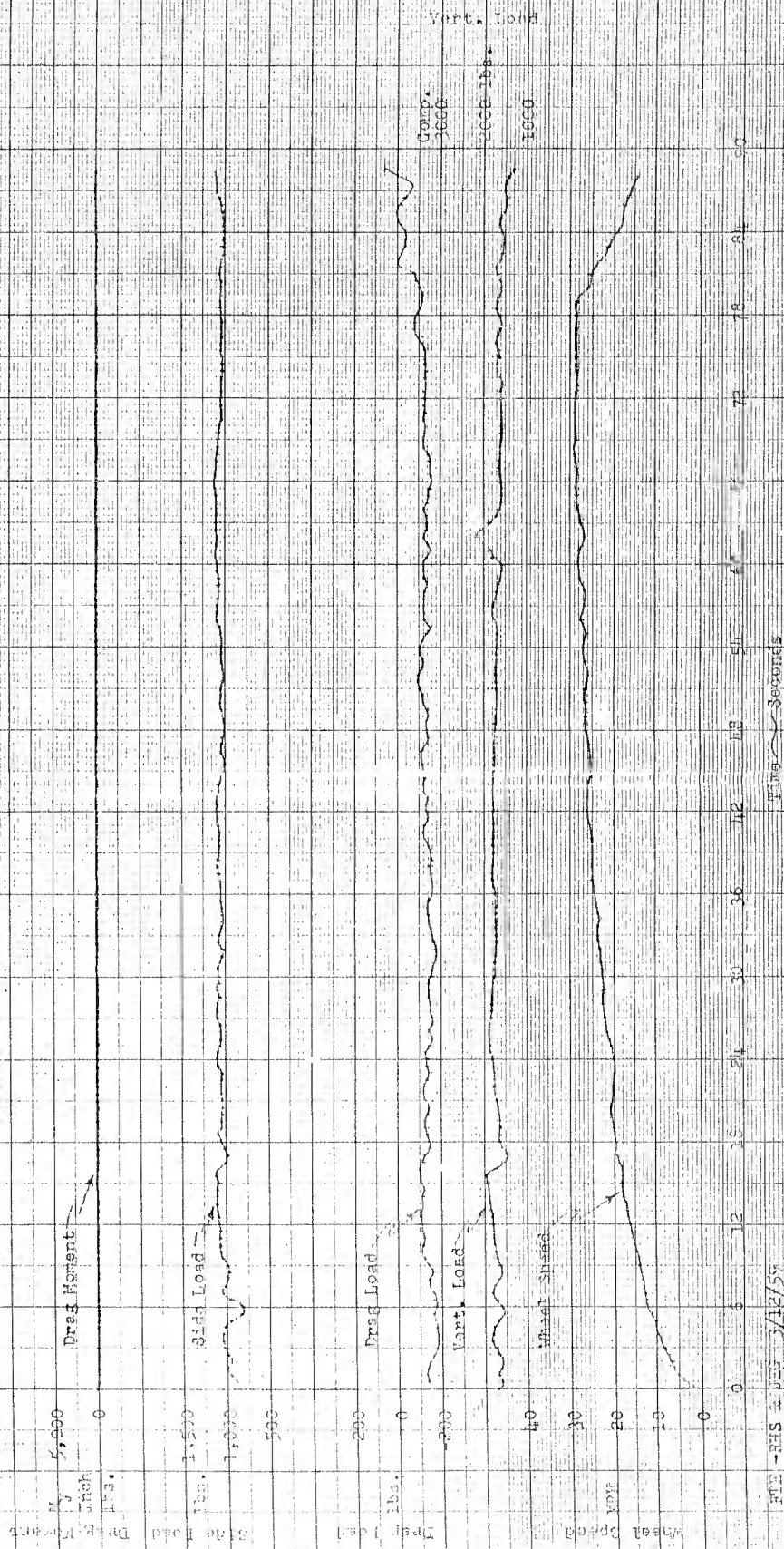
| | |
|--|--------------|
| | Brake footed |
|--|--------------|

TIME HISTORY - HIGH FLIGHT TEST
(Drag Moment (M_y), Side Load, Drag Load, And Wheel Speed)

Record No. 12382

February 19, 1959

Nominal Test Conditions: Tire Pressure 12 PSI, 1500 lbs. Vertical Load, Camber Angle 25°
Actual Vertical Load - 1750 lbs. \pm 100



HIGH FLOTATION TIRE TEST

(Vertical Load Vs. Side and Drag Loads)

Record No. 12391

Date 24 Feb. 59

Nominal Test Conditions: Tire Pressure 12 PSI

1500 lbs. Vertical Load

Camber Angle 15°

Drag Load - lbs.

Side Load - lbs.

200

0

-200

1500

1000

500

-20

-19

-18

-17

-16

-15

-14

-13

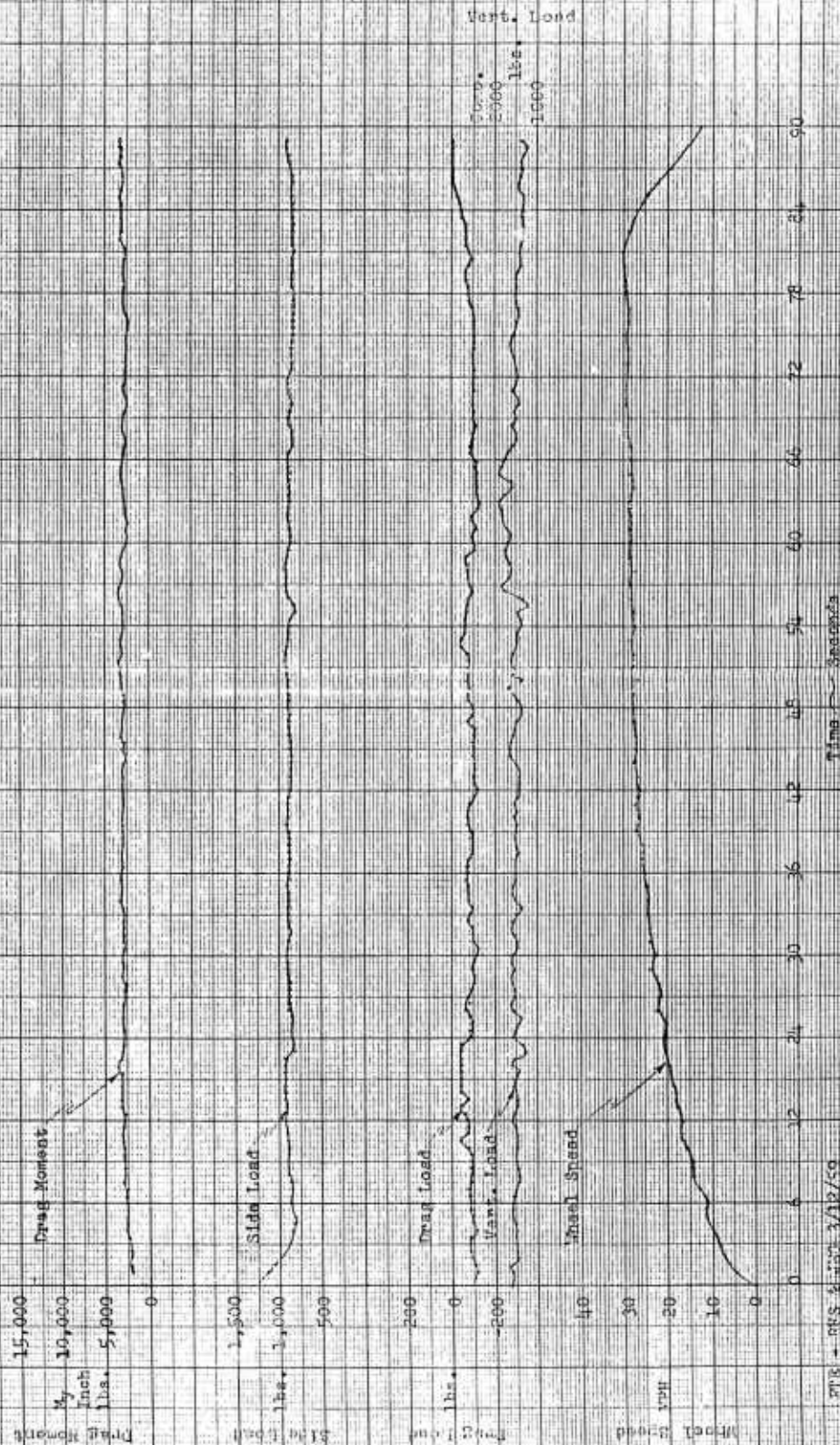
-12

Compression

Vertical Load - lbs. X 100

TIME HISTORY - HIGH FLOATION TIRE TEST
(Drag Moment (M_y), Side Load, Drag Load, And Wheel Speed)

Record No. 1219
February 25, 1959
Nominal Test Conditions: Tire Pressure 12 PSI, 1500 lbs. Vertical Load, Camber Angle 15°
Actual Vertical Load - 1570 lbs. +300



HIGH FLOTATION TIRE TEST

(Vertical Load Vs. Side and Drag Loads)

Record No. 12392

Date 25 Feb. 59

Nominal Test Conditions: Tire Pressure 12 PSI

3000 lbs. Vertical Load

Camber Angle 15°

Drag Load ~ lbs.

Side Load ~ lbs.

Compression

Vertical Load ~ lbs. X 100

200

0

-200

1500

1000

500

-36

-35

-34

-33

-32

-31

-30

-29

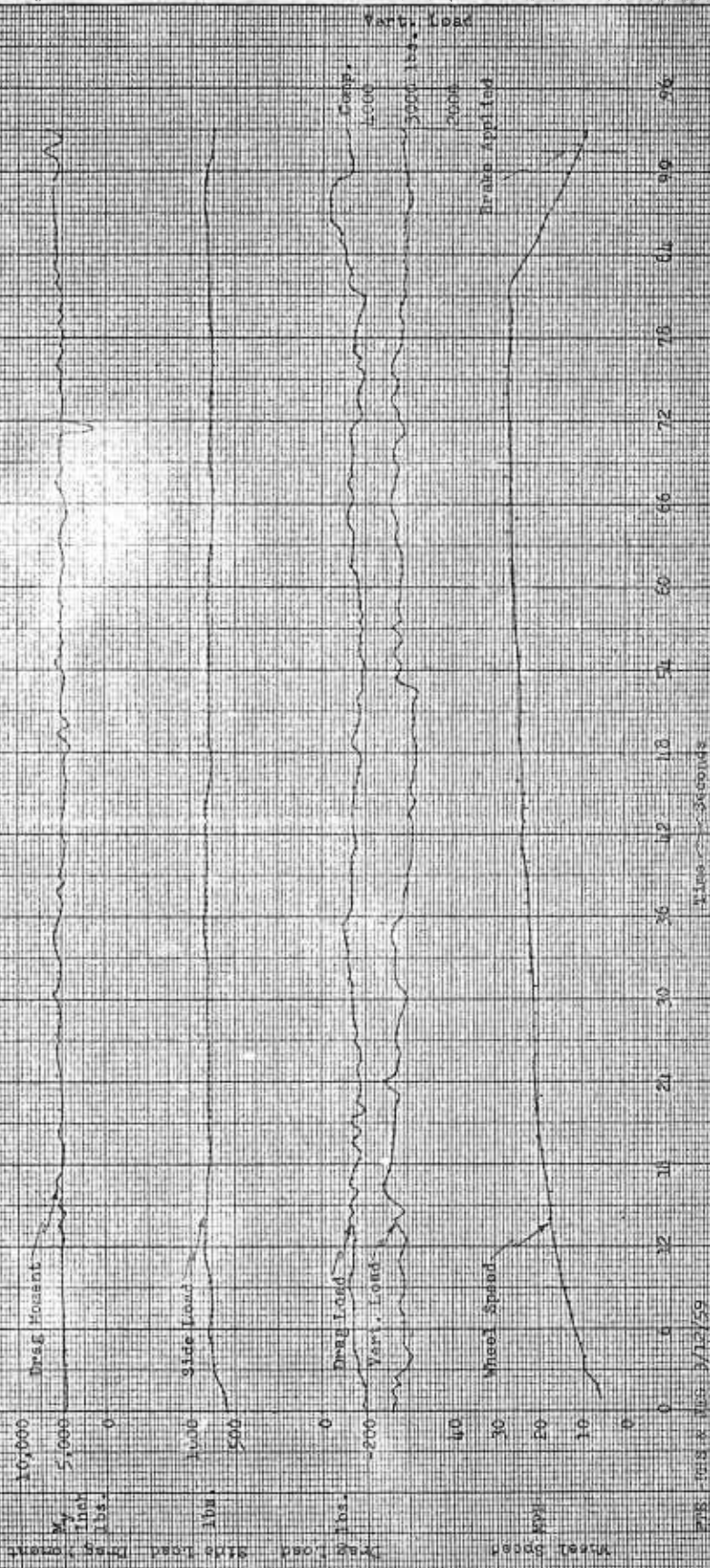
-28

-27

FTE

TIME HISTORY - HIGH ELEVATION TIRE TEST
(Drag Moment (W/L), Side Load, Drag Load, and Wheel Speed)

Record No. 12352 February 25, 1959
Nominal Test Conditions: Tire Pressure 12 PSI, 3000 lbs. Vertical Load, Camber Angle 1°
Actual Vertical Load - 2800 lbs. 1400



TIME HISTORY - HIGH ROTATION TIRE TEST

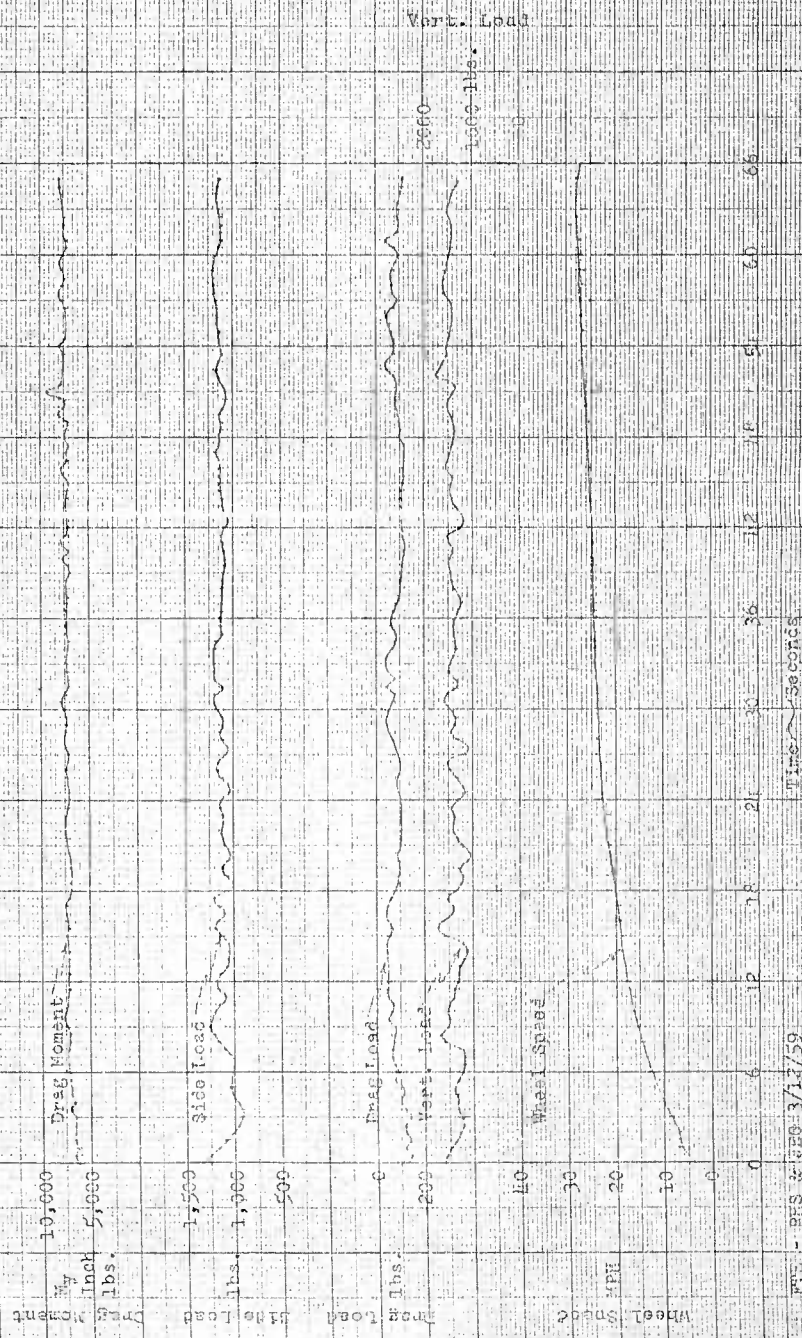
(Drag Moment (M_T), Side Load, Drag Load, and Wheel Speed)

Record No. 12393

February 25, 1959

Nominal Test Conditions: Tire Pressure 20 PSI, 1500 lbs. Vertical Load, Camber Angle 1°

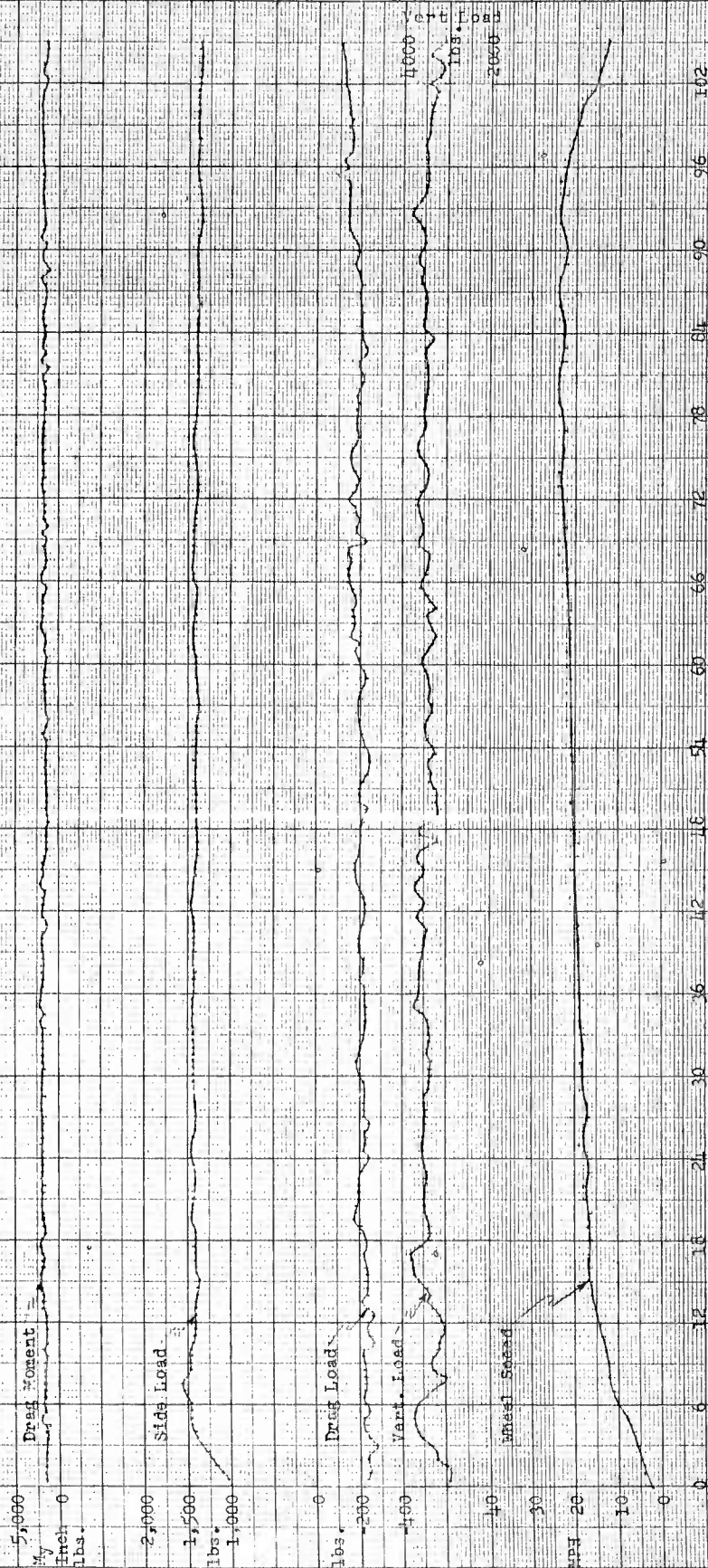
Actual Vertical Load - 1400 lbs. - 300



PTS - PHS & PEO 3/12/59

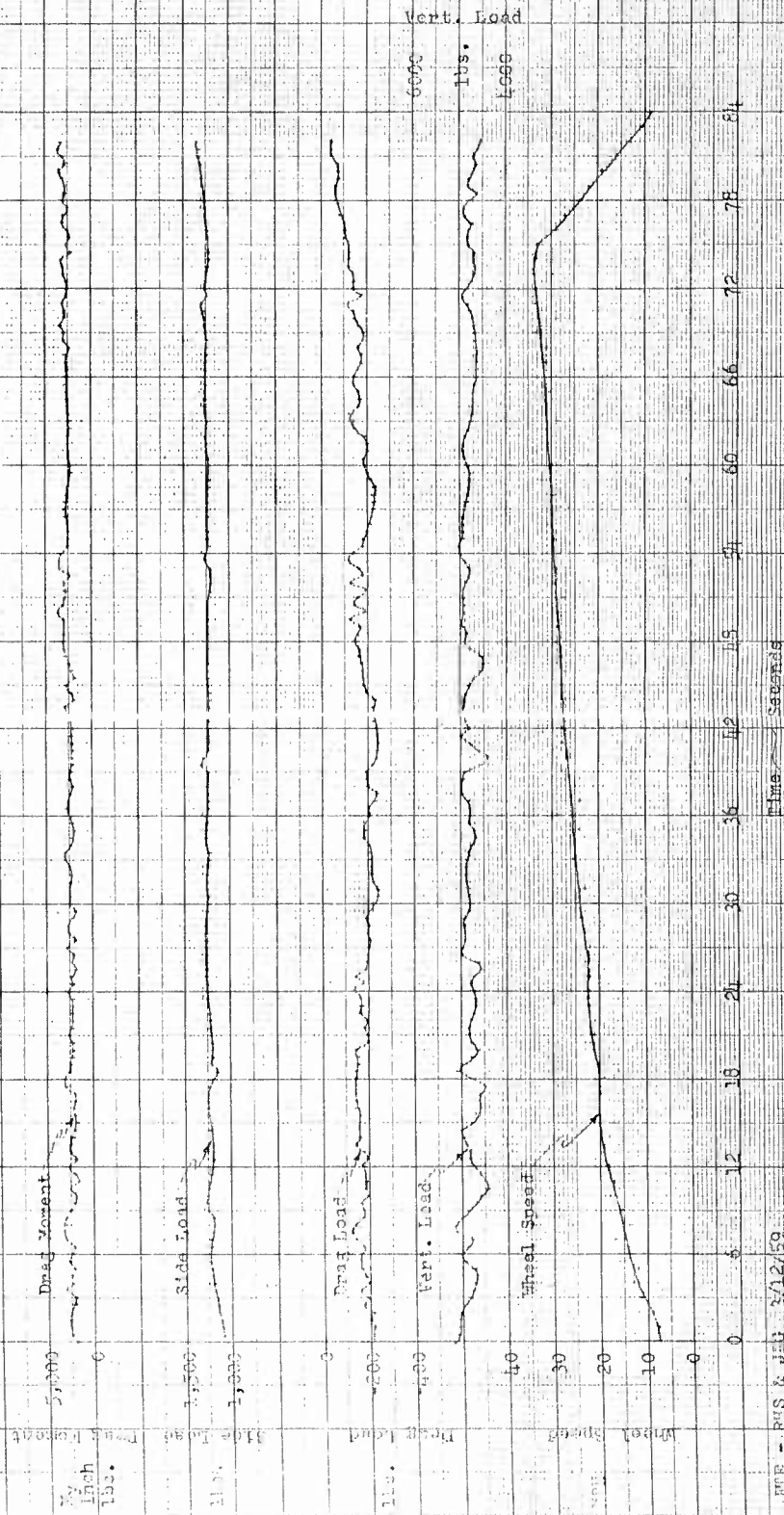
TIME HISTORY - HIGH FLOATION TIRE TEST
(Drag Moment (W_y), Side Load, Drag Load, And Wheel Speed)

Record No. 12394 February 25, 1959
Nominal Test Conditions: Tire Pressure 20 PSI, 3000 lbs. Vertical Load, Camber Angle 15°
Actual Vertical Load - 3450 lbs. F 400



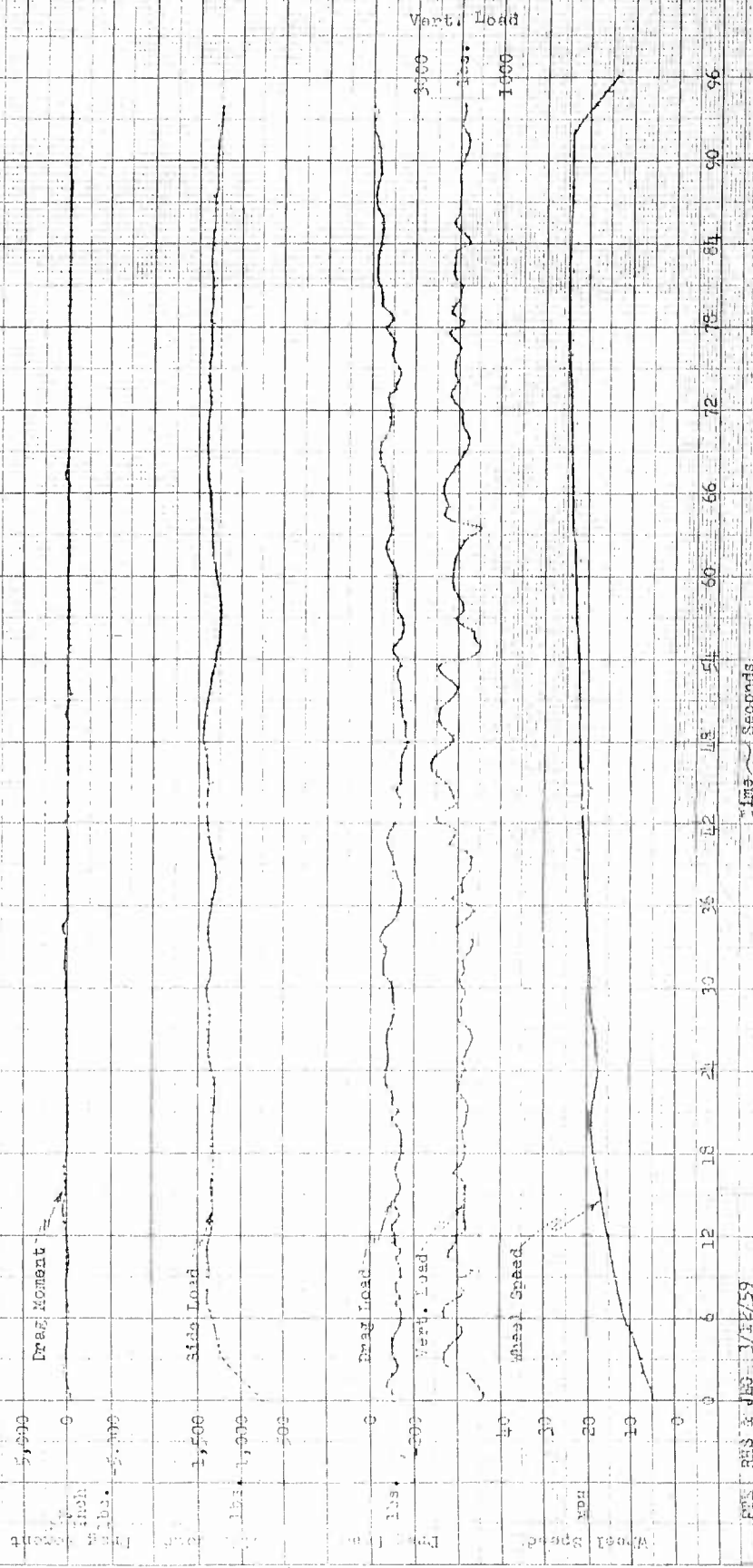
FIVE HISTORY - HIGH MAGNETATION TIRE TEST
(Drag Moment (Hy.), Side Load, Drag Load, and Wheel Speed)

Record No. 12395
Nominal Test Conditions: Tire Pressure 20 PSI, 4500 lbs. Vertical Load, Camber Angle 15°
Actual Vertical Load - 4800 lbs. \pm 300



TIRE HISTORY - HIGH TRACTION TIRE TEST
(Drag Moment (M_y), Side Load, Drag Load, and Wheel Speed)

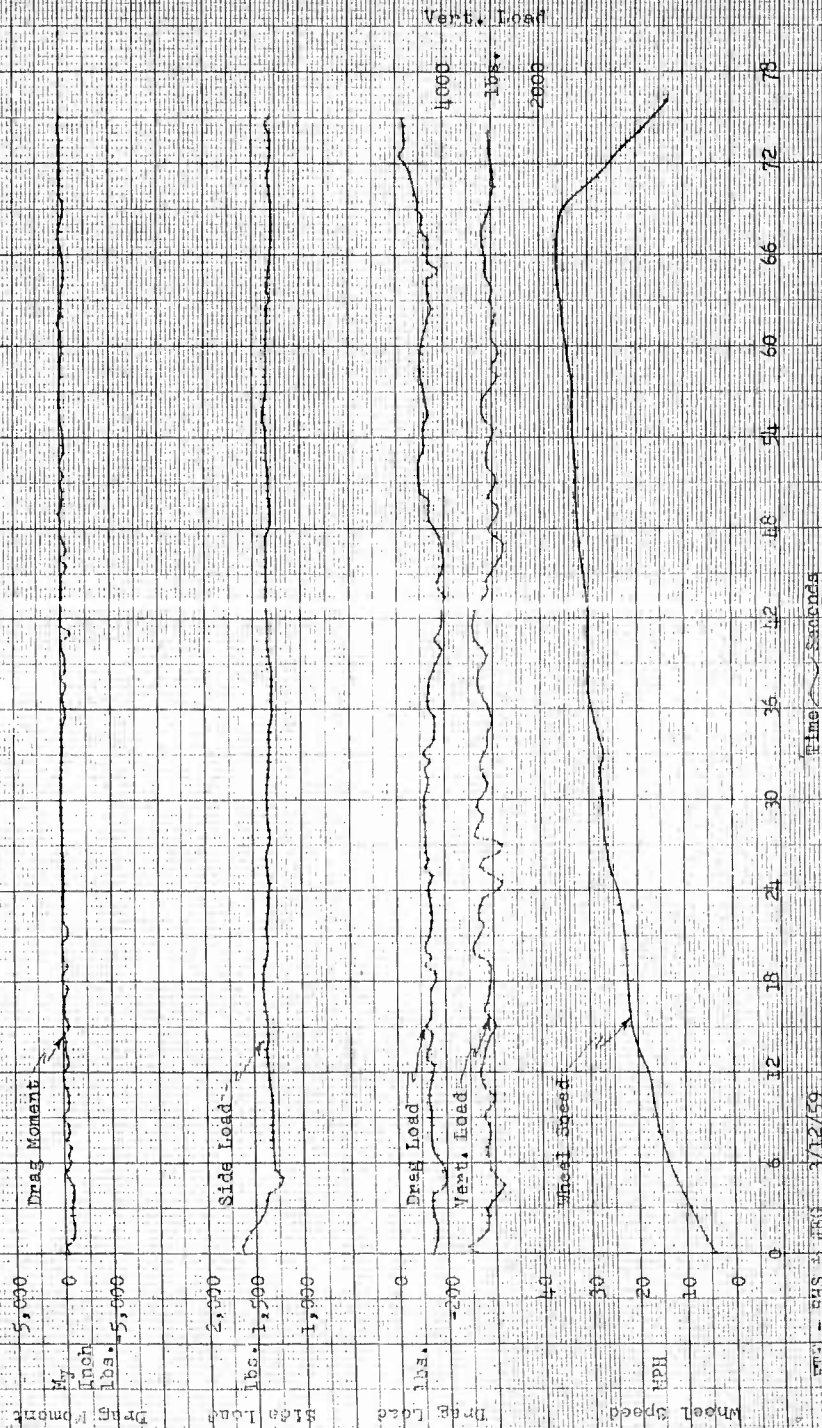
Record No. 12196
February 25, 1959
Nominal Test Conditions: Tire Pressure 24 PSI, 1500 lbs. Vertical Load, Camber Angle 15°
Actual Vertical Load - 2000 lbs. - 500



TIRE TEST 12196 3/1/59

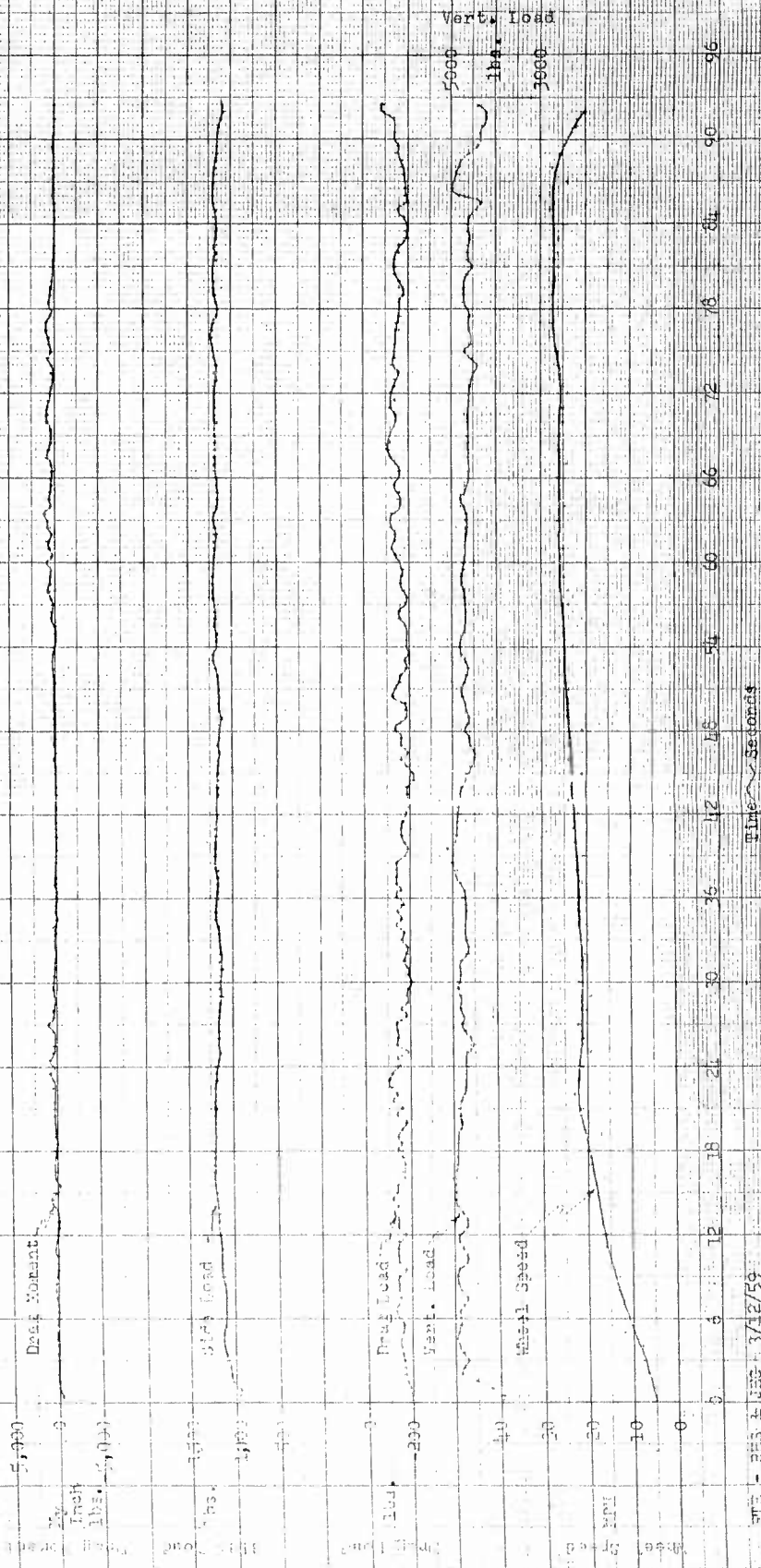
TIME HISTORY - HIGH FLUTATION TIRE TEST
(Drag Moment (My), Side Load, Drag Load, and Wheel Speed)

Record No. 12397 February 25, 1959
Nominal Test Conditions: Tire Pressure 24 PSI, 3000 lbs. Vertical Load, Camber Angle 15°
Actual Vertical Load - 3100 lbs. ± 100



TIME HISTORY - HIGH FLATION TIRE TEST
(Drag Moment (M_y), Side Load, Drag Load, and Wheel Speed)

Record No. 12298 February 25, 1959
Nominal Test Conditions: Tire Pressure 24 PSI, 4500 lbs. Vertical Load, Camber Angle 15°
Actual Vertical Load - 4770 lbs. ± 300

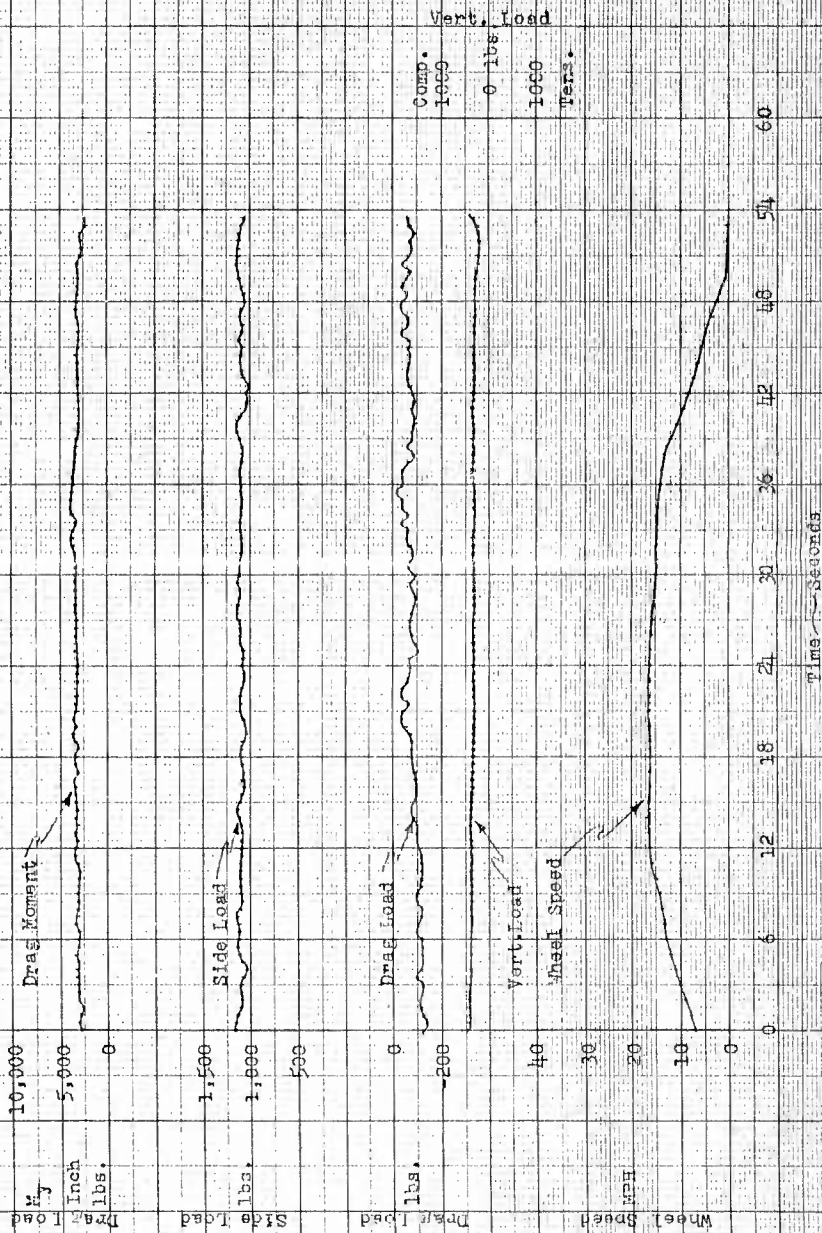


TIME HISTORY - HIGH PEAKING TIRE TEST
(Drag Moment (M_y), Side Load, Drag Load, And Wheel Speed)

March 9, 1959

Record No. 12470

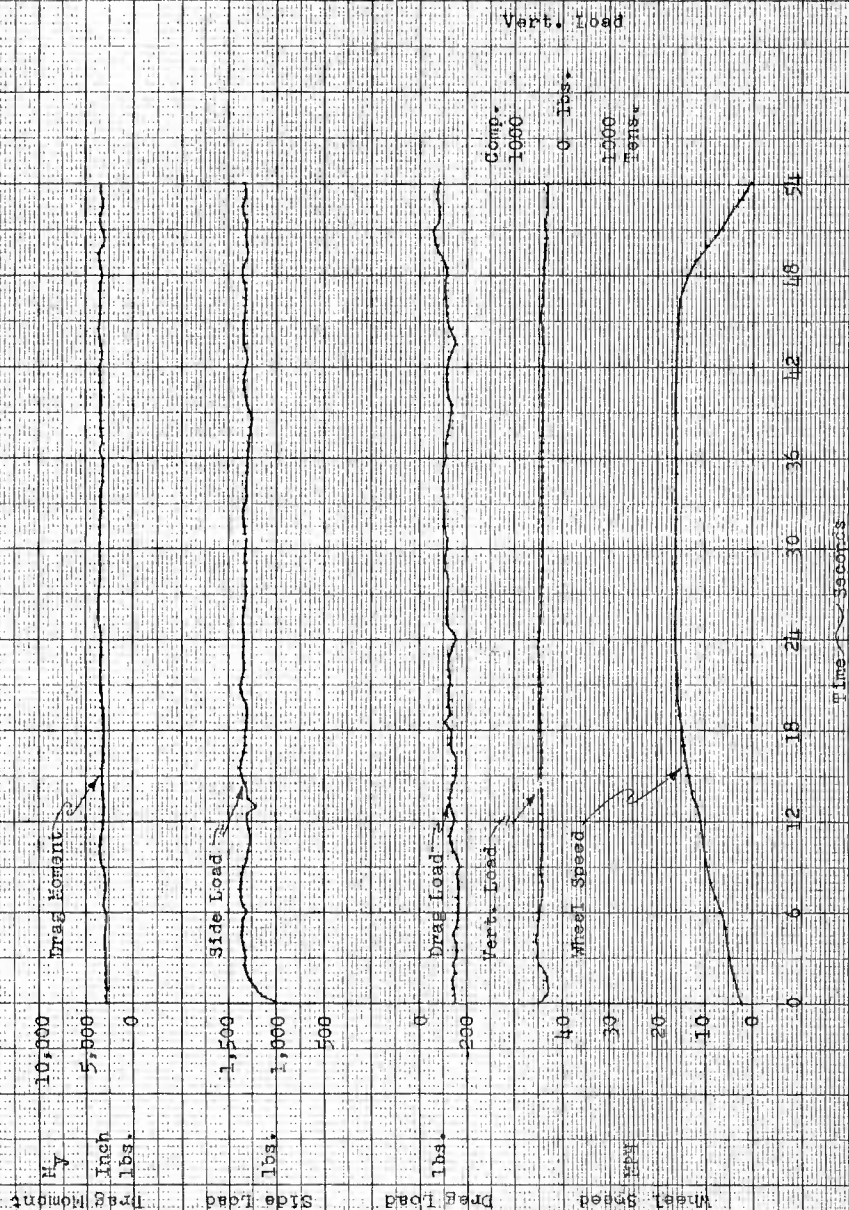
Test Conditions: Tire Pressure 3.5 PSI, 800 lbs. Vertical Load, Gaster Angle 15°



RTS - RRS X 500 3/24/59

TIRE HISTORY - HIGH ROTATION TIRE TEST
(Drag Moment (H. I. Side Load, Drag Load, And Wheel Speed)

Record No. 12171
Test Conditions: Tire Pressure 4 PSI, 1000 lbs. Vertical Load, Caster Angle 15°
March 9, 1959



FTS-RCS & JEG 3/24/59

HIGH FRETATION TIRE TEST

(Vertical Load Vs. Side and Drag Loads)

Record No. 12457

Date 3 Mar. 59

Nominal Test Conditions: Tire Pressure 24 PSI

1500 lbs. Vertical Load

Caster Angle 15°

Drag Load, lbs.

Side Load, lbs.

Compression

Vertical Load, lbs. X 100

Tension

200

0

-200

2500

2000

1500

1000

500

0

-7

-6

-5

-4

-3

-2

-1

0

1

2

ATE

TIME HISTORY - HIGH FLATION TIRE TEST

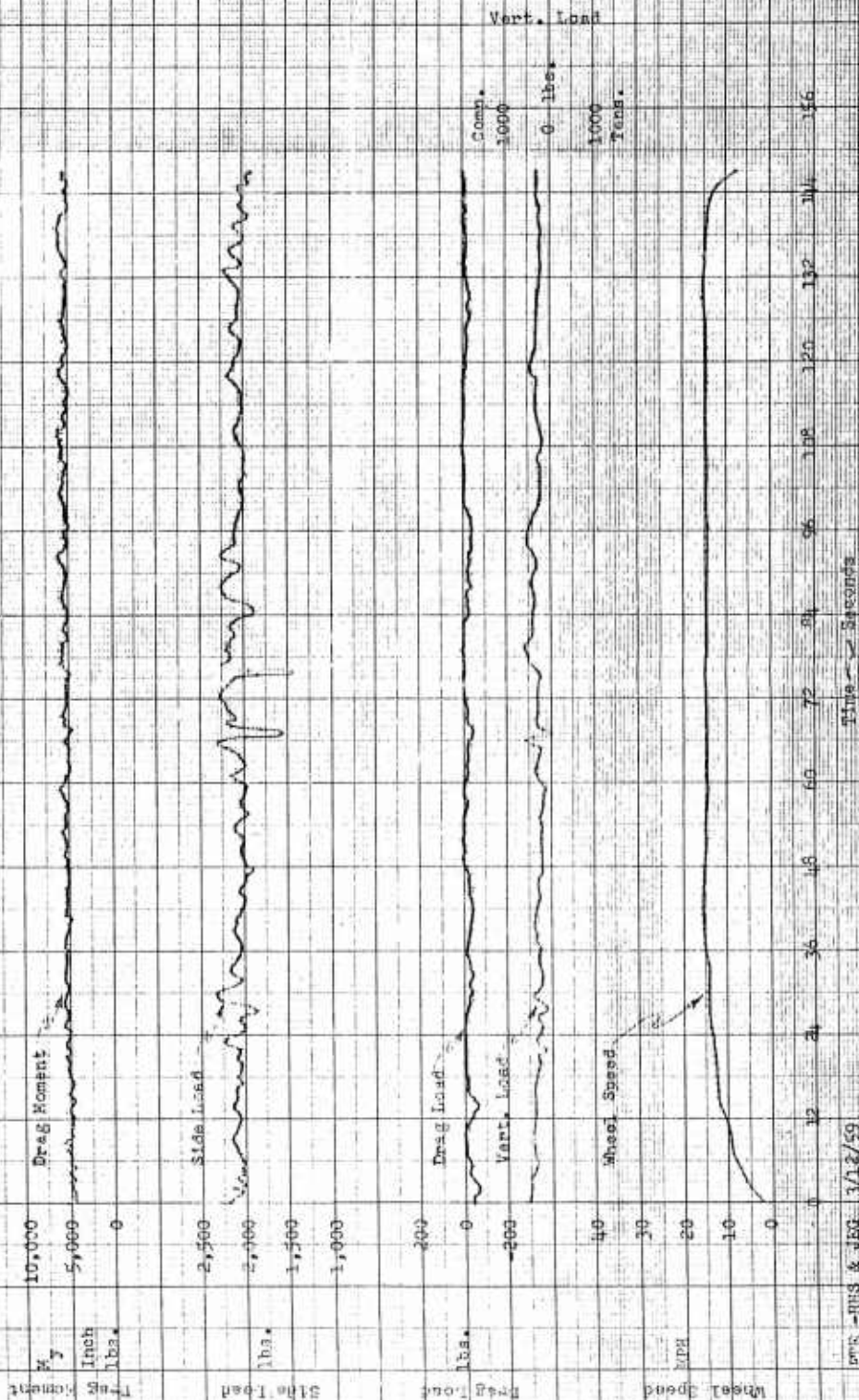
(Drag Moment (M_y), Side Load, Drag Load, And Wheel Speed)

Record No. 12457

March 3, 1959

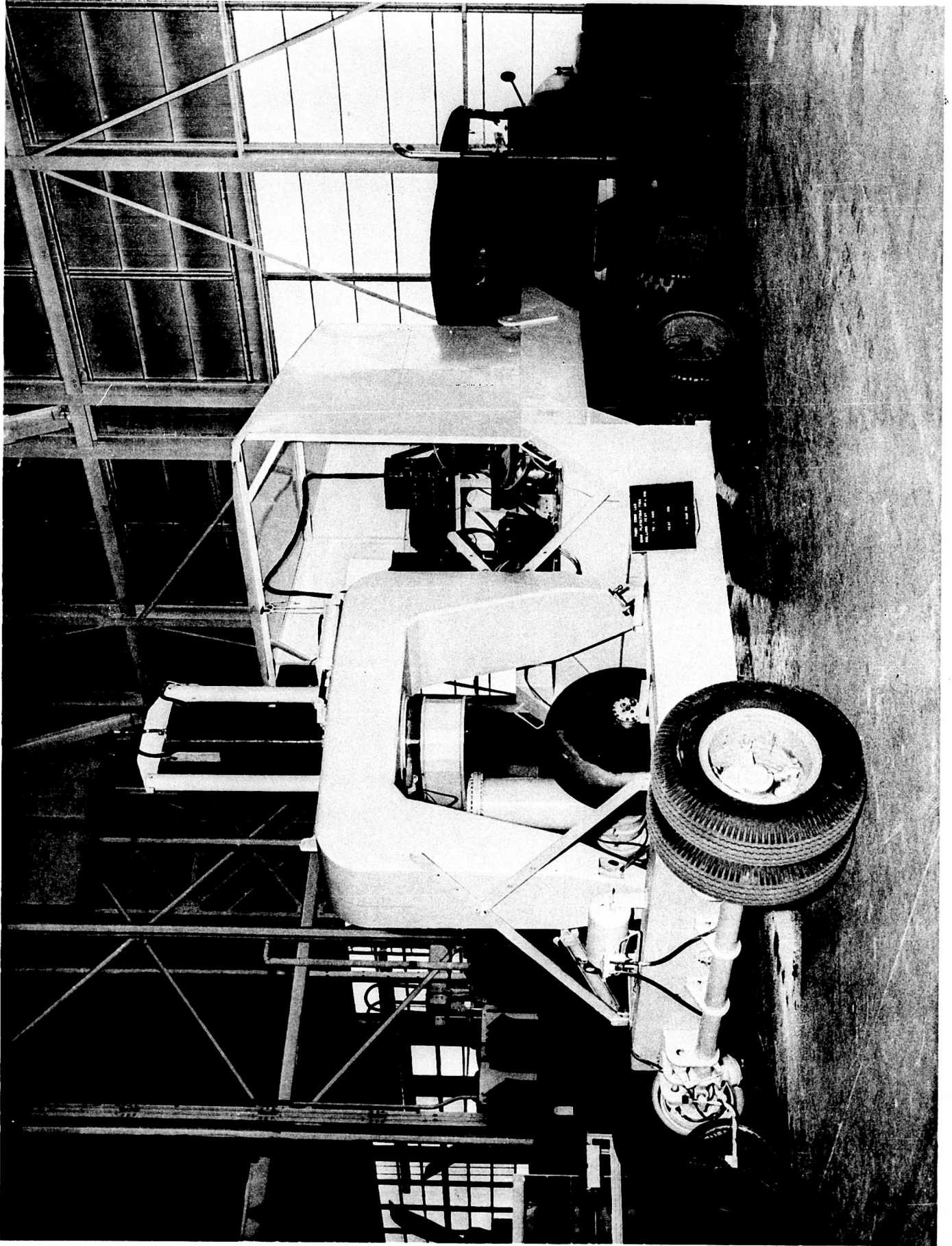
Nominal Test Conditions: Tire Pressure 24 PSI, 1500 lbs. Vertical Load, Caster Angle 15°

Actual Vertical Load = 1000 lbs. = 200



FAMD ENGR. LAB
HIGH FLOTATION TIRE
ROLLING TEST 43 IN DIA
TR-L-605

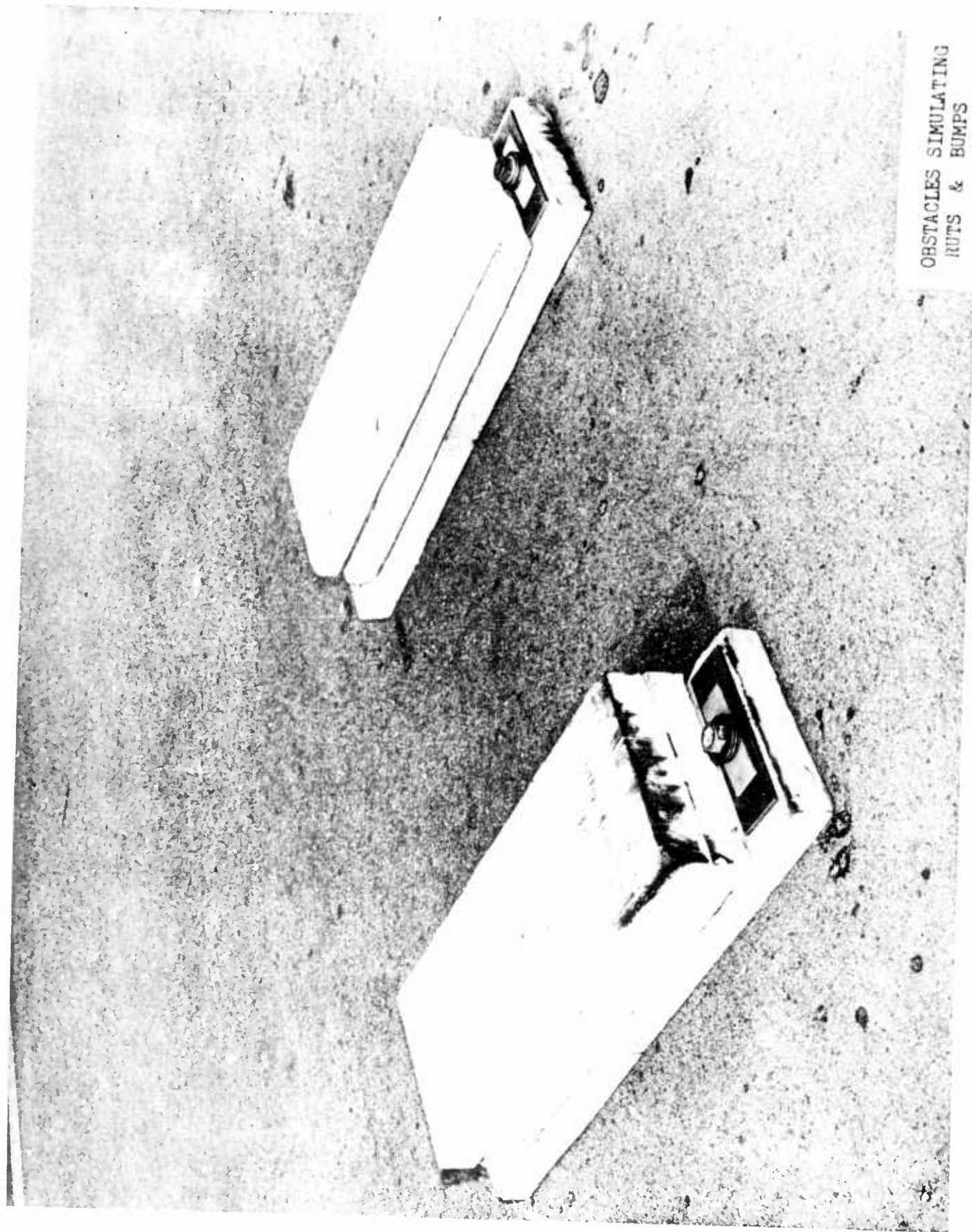
CONDITION OF TIRE
AFTER STEERING TESTS
28 FEB. 59





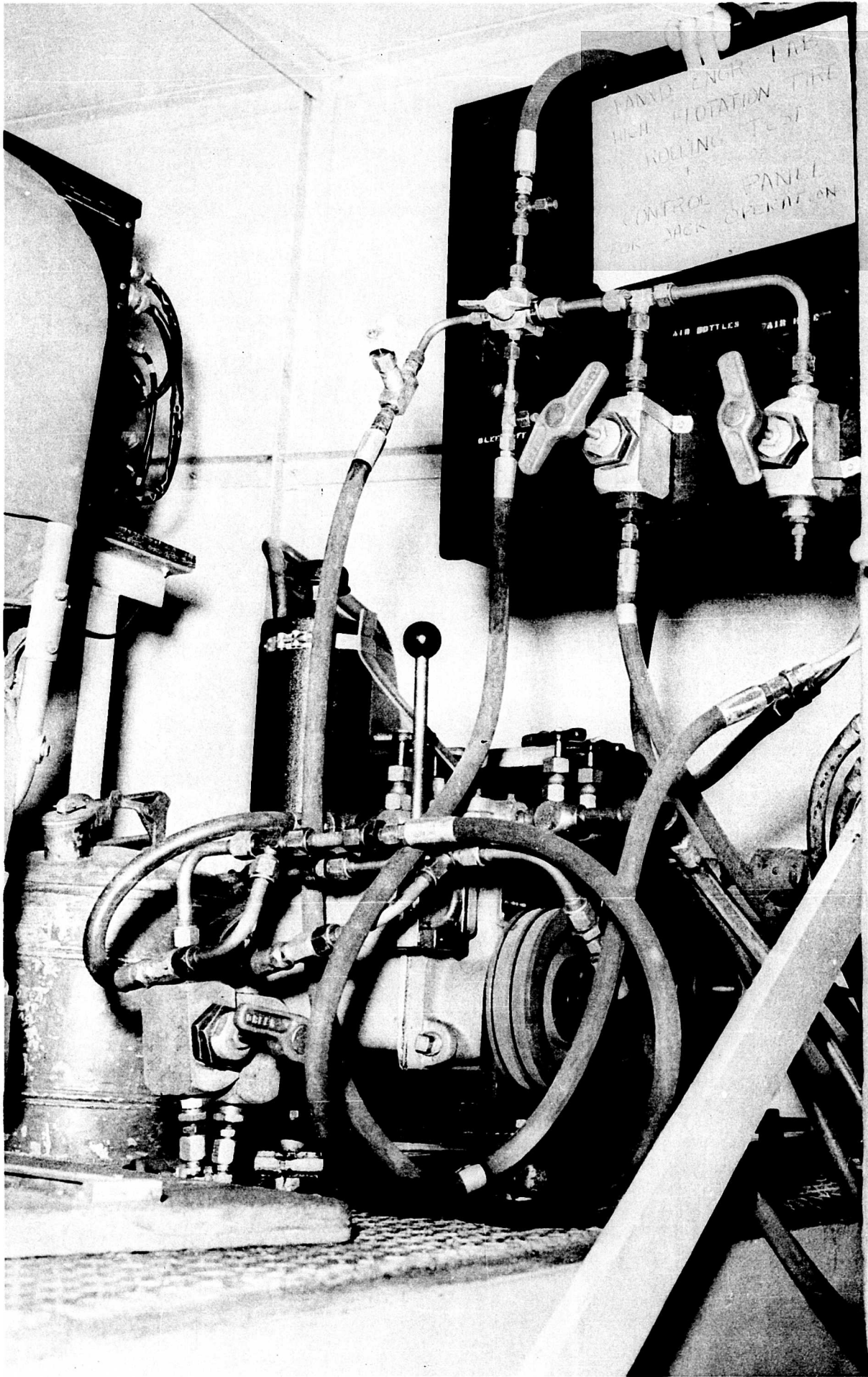
DITCH SIMULATING
POT HOLES.

OBSTACLES SIMULATING
RUTS & BUMPS

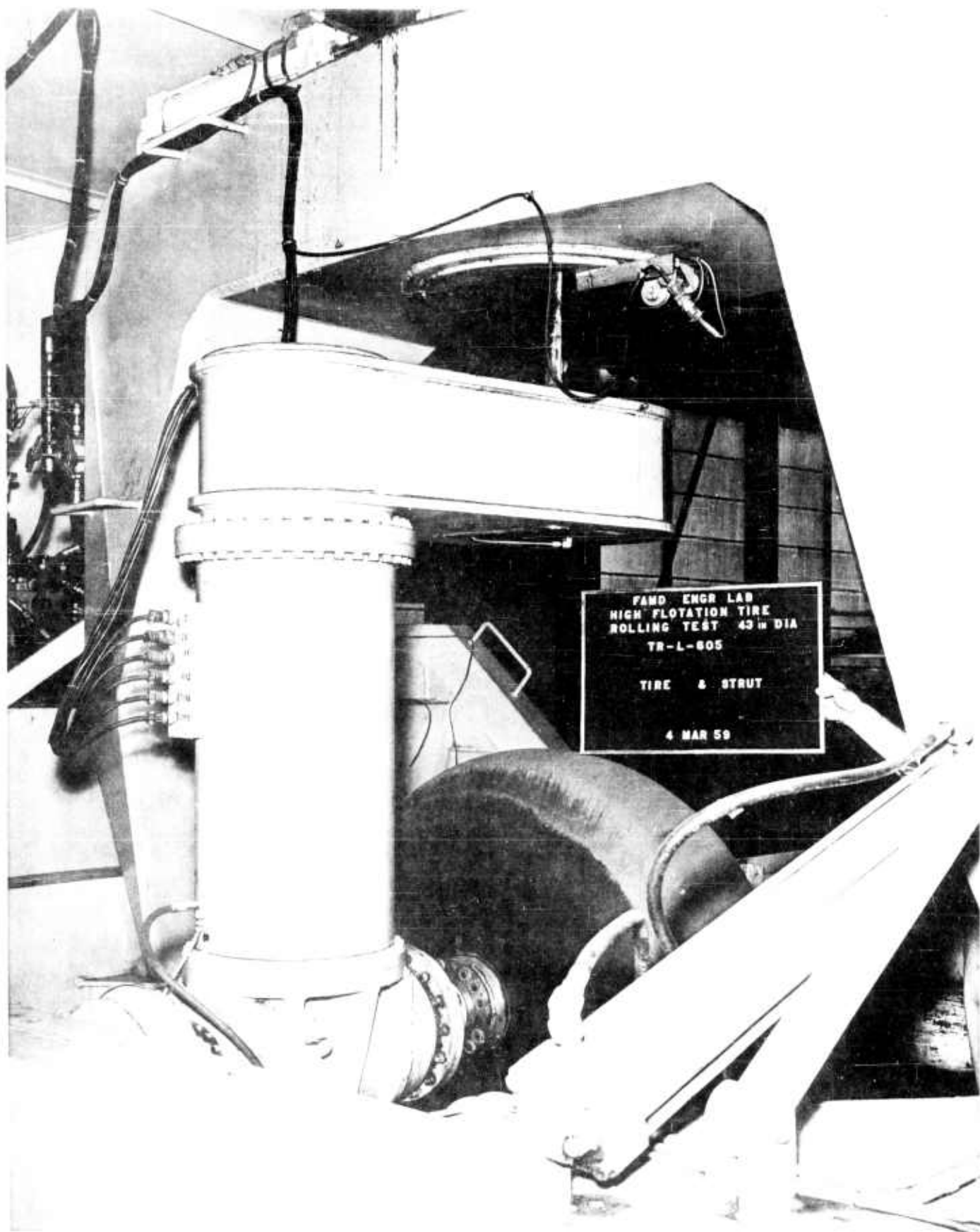


PANAL ENGR. TIRE
HIGH ROTATION TIRE
ROLLING TEST
CONTROL PANEL
FOR JACK OPERATION

AIR BOTTLES PAIR



FAMD ENGR LAB
HIGH FLOTATION TIRE
ROLLING TEST
TR L-605
HELIPOT FOR MEASURING
TURNING IN STREET
3-19-59



FAND ENGR LAB
HIGH FLOTATION TIRE
ROLLING TEST 43 in DIA
TR-L-605

TIRE & STRUT

4 MAR 59

FAIRCHILD AIRCRAFT AND MISSILES DIVISION

H A G E R S T O W N 10, M A R Y L A N D

SUBJECT THE DESIGN AND DEVELOPMENT OF LABORATORY MODELS TO STUDY

THE FEASIBILITY OF HIGH-FLOTATION TIRES FOR AIRCRAFT



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PHASE REPORT

on

THE DESIGN AND DEVELOPMENT OF LABORATORY MODELS
TO STUDY THE FEASIBILITY OF HIGH-FLOTATION TIRES
FOR AIRCRAFT

to

FAIRCHILD AIRCRAFT DIVISION
FAIRCHILD ENGINE AND AIRPLANE CORPORATION

August 1, 1958

by

J. A. Hoess, W. F. Prien, J. H. Beck, C. W. Rodman, S. A. Gordon,
J. F. Voorhees, and R. J. McCrory

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio

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THE DESIGN AND DEVELOPMENT OF LABORATORY MODELS
TO STUDY THE FEASIBILITY OF HIGH-FLOTATION TIRES
FOR AIRCRAFT

by

J. A. Hoess, W. F. Prien, J. H. Beck, C. W. Rodman,
S. A. Gordon, J. E. Voorhees, and R. J. McCrory

During the period from June 27, 1956, through April 22, 1957, a research program entitled "An Analytical Study of High-Flotation Tires for Aircraft" was conducted at Battelle for the Fairchild Aircraft Division. Battelle's analysis in that research program indicated the feasibility of using high-flotation tires to dissipate the impact energy of landing aircraft. To demonstrate the validity of the conclusions drawn in this analytical program, the Fairchild Aircraft Division requested Battelle to submit a proposed research program on the construction of the associated equipment required for the mounting and laboratory testing of two high-flotation landing-gear systems. In response to this request, Battelle submitted a proposed research program, "The Design and Development of Laboratory Models to Study the Feasibility of High-Flotation Tires for Aircraft", dated March 15, 1957. An agreement was concluded between Battelle and Fairchild for this study. The present report covers the work on this program from its initiation on June 1, 1957, to June 1, 1958.

The objectives of the program listed in the proposed research program are:

- (1) The development of two full-scale laboratory-model, high-flotation landing-gear systems meeting the specifications called for in the feasibility study. The static load ratings of the two units were to be 750 pounds and 1500 pounds.
- (2) The design and construction of the equipment required for the mounting and laboratory testing of the two units.
- (3) Laboratory testing of the high-flotation system components.

During the development of the first high-flotation landing-gear model, laboratory drop testing of the assembled unit was undertaken to provide insight into the actual operation of the complete high-flotation system. Because of the successful operation obtained with the first laboratory model, the design of the second unit was changed to make it adaptable to aircraft installation for flight evaluation.

This phase report covers the design, development, and testing of a high-flotation landing-gear system designed to carry a static load of 750 pounds.

SUMMARY

The high-flotation landing-gear concept embodies two basic objectives: (1) to provide a low-pressure tire capable of supporting the weight of an aircraft on soft soil or sand and capable of rolling over ruts and other obstructions without transmitting large forces to the airframe and (2) to dissipate the kinetic energy of the aircraft due to its vertical velocity, or sinking speed, by bleeding air out of the tire at the time of contact with the ground. The ability to dissipate energy would prevent excessive bouncing and eliminate the need for an oleo strut.

A third design requirement resulted from the large size of the high-flotation tires - the tires must be folded for retraction after take-off. This requirement and the necessity for light weight in aircraft components dictated a thin, flexible tire construction.

The function of energy dissipation required that a large, rapid-acting valve be designed to bleed a large volume of air out of the tire during the first fraction of a second after contact with the ground. Because of the speed of valve actuation required, it was first considered necessary to employ a power-operated valve mechanism. The use of powered-valve actuation with its associated controls has been discarded because of its complexity and because it is doubtful whether its response and reliability would be satisfactory. Valve actuation is being accomplished by a deflection between the tire hub and the strut under load.

The components of the high-flotation landing gear designed to carry a static load of 750 pounds have been designed to be extremely flexible for laboratory evaluation. Each component was tested to determine its characteristics before being assembled into the complete unit. This component testing proved to be especially valuable in the valve design, where the sleeve valve first proposed permitted excessive leakage and was replaced by a redesigned valve before actual testing of the complete landing gear was begun.

A pressure-sensing device which closes the valve at a given minimum tire pressure regardless of the load on the landing gear and which permits take-offs at elevated tire pressures without danger of valve actuation has been incorporated into the design. This function was not called for in the analytical specifications, but is considered to be necessary for successful operation of the system.

The helical bellows method proved to be the most successful method of tire folding. To induce the high-flotation tire to fold into a helical bellows, it is necessary to attach stiffening ribs to the tire and draw a vacuum of 12 inches of water inside the tire. This causes the tire to twist and collapse axially, forming a helical bellows without any external actuation other than the differential pressure across the walls of the tire.

A drop-test apparatus was constructed at Battelle to evaluate the dynamic characteristics of the assembled unit. Drop tests with this apparatus were made with various combinations of initial tire pressure, static load, sinking speed, and valve configuration. The results of these tests were highly satisfactory. The 34-inch-diameter high-flotation tire with a total load of 780 pounds was successfully tested at sinking speeds up to 8-1/4 feet per second with a maximum load factor of 3.8. Load factor is defined as the ratio of instantaneous vertical load to total static weight.

HIGH-FLOTATION LANDING-GEAR DESIGN

Design Specifications Determined in Analytical Study

The feasibility of using high-flotation landing-gear systems to dissipate the impact energy of landing aircraft was demonstrated, within the limits of accuracy of the analysis, in Battelle's research program, "An Analytical Study of High-Flotation Tires for Aircraft". This program resulted in a set of specifications for the operation of the air-bleeding system and for the geometry and fabrication of the high-flotation tires. Calculations showed that the orifices of the valves which bleed air from the tires during the landing impact must be 9, 14, 27, and 42 square inches in area for the 750, 1500, 4000, and 7500-pound static-load tire systems, respectively. The orifices must open wide in 5 milliseconds or less after the instantaneous load on the tire reaches 1.35 times the static weight. They must close completely in 25 milliseconds or less after the instantaneous load falls below 1.35 times the static weight. The tire diameters should be 34, 43, 60, and 74 inches for the 750, 1500, 4000, and 7500-pound static-load tire systems, respectively, and the initial tire pressure should be 17 psig for all four systems.

Early Design Concepts

To meet these specifications, a design study was conducted on various methods of load sensing and valve actuation. Most of the early concepts depended upon powered-valve actuation, either hydraulic or pneumatic, which was controlled by some type of independent load sensor such as an accelerometer. One typical system considered for valve actuation is shown in Figure 1. This system is a pneumatic or hydraulic servo-mechanism. The valve would be actuated by a power piston controlled by the load input and by an overriding pressure input which would close the valve when a given minimum tire pressure was reached. The sequence of operations for this system would be as follows:

- (1) The load input is moved to the right with increasing load.
- (2) A suitable linkage moves the spool valve to the right, and pressurized fluid enters the chamber on the backside of the power piston.
- (3) The power piston moves to the left and opens the valve.
- (4) As the valve opens, the spool valve is returned to its original position, thus halting the power piston. Therefore, a given position of the load-input rod would result in a given valve position.
- (5) When a given minimum pressure is reached, the pressure-input rod is actuated and overrides the load input. The spool valve is thus moved to the left, allowing pressurized fluid to enter the chamber on the front side of the power piston.

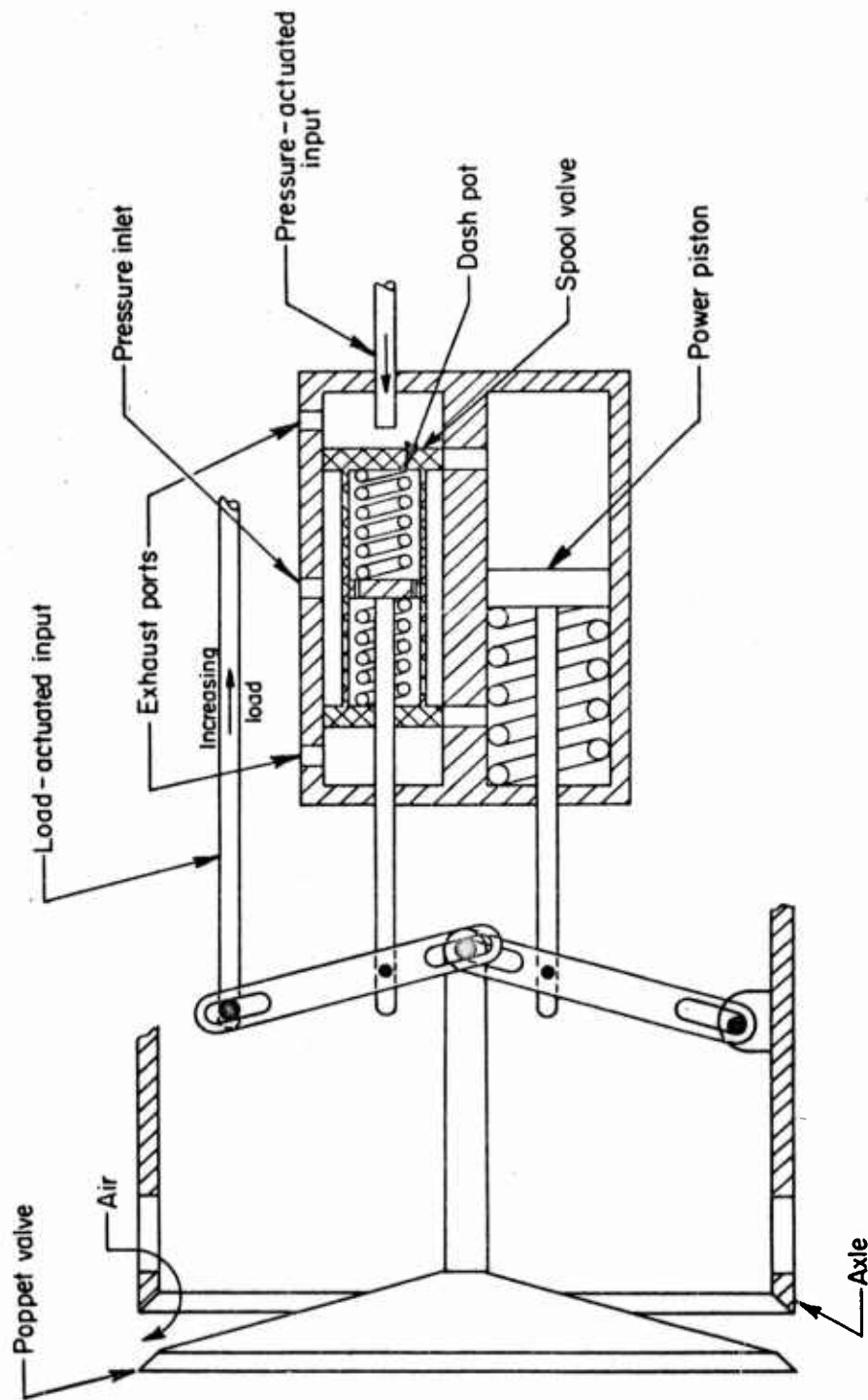


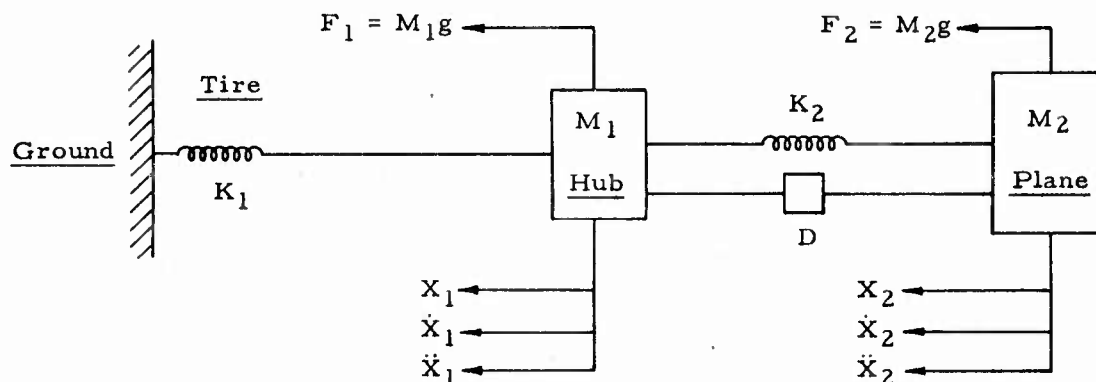
FIGURE 1. SCHEMATIC DIAGRAM OF PNEUMATIC OR HYDRAULIC SERVOMECHANISM WITH LOAD AND OVER-
RIDING PRESSURE CONTROLS FOR VALVE ACTUATION

- (6) The power piston moves to the right, closing the valve. The spring on the front side of the power piston would close the valve in case of a failure in the fluid supply system.

Such systems presented many problems. They were fairly complex and required external power sources for valve actuation. It was also doubtful whether or not their response and reliability would be satisfactory. Because of these problems, an investigation was carried out to study the feasibility of using directly the force imposed on the landing gear for valve actuation.

Theoretical Basis for Direct Valve Actuation

A computer study was made of the dynamic response of the wheel-hub assembly during a landing to determine whether this response was fast enough to be used for valve actuation. The following system was considered in this study:



K_1 Undeformed tire spring rate, 12,000 lb/ft

K_2 Load-sensing spring rate, 18,000 lb/ft

M_1 Tire hub assembly mass, 1.16 slugs

M_2 Plane mass, 22.1 slugs

D Dashpot rate, 100 lb-sec/ft.

The basic dynamic equations for this system are:

$$K_1 X_1 + M_1 \ddot{X}_1 - K_2 (X_2 - X_1) - D (\dot{X}_2 - \dot{X}_1) = F_1 = M_1 g \quad (1)$$

$$K_2 (X_2 - X_1) + D (\dot{X}_2 - \dot{X}_1) + M_2 \ddot{X}_2 = F_2 = M_2 g \quad (2)$$

Figure 2 is a graph of the dynamic response results obtained for a landing of this system at a sinking speed of 8.4 ft/sec. In such a landing a relative movement of $3/8$ inch between the wheel hub and the fixed strut would occur in about 0.015 second after touchdown. The force acting to produce this movement would reach over 900 pounds in that time. These results indicate that it is feasible to use the force and deflection between the tire hub assembly and the strut for valve actuation.

Design of Components of the 750-Pound Landing-Gear Unit

The high-flotation landing gear designed to carry a static load of 750 pounds was designed strictly as a laboratory test apparatus. Flexibility and adjustability were stressed throughout, to permit testing the 750-pound unit at conditions other than those specifically called for in the analytical study. This has necessarily resulted in a heavier unit than would be needed for aircraft applications.

Landing-Gear Linkage

Valve actuation in the 750-pound unit is accomplished by means of the deflection between the tire hub assembly and the strut. To obtain a deflection that would be sensitive only to the vertical load on the landing gear, it was first considered that a telescoping section should be provided in the main strut. The use of a telescoping main strut was discouraged, however, because it was thought that extremely heavy sections would be required to prevent deflections due to bending forces from detrimentally influencing the load-sensing function. Therefore, a linkage which would remove the major bending forces from the load sensor was devised.

Figure 3 is a picture of the landing-gear linkage. A telescoping load sensor is mounted in parallel with the main strut. The axle housing is connected to the main strut by means of a horizontal link, and the load sensor is fastened to the main strut by means of a ball joint which is free to move in a direction parallel to the center line of the axle. This type of mounting leaves the load sensor free of bending moments which might be imposed by tire loading, misalignments, or deflections of parts under load. The only bending moment carried through the load sensor is a small one which is imposed when the brakes are applied.

Axle, Axle Housing, and Brake

The air is bled from the tire through a tubular axle. Since the analytical study called for an orifice area of 9 square inches, it would be necessary to use a tubular axle with an internal diameter of about $3-3/8$ inches. Because of tire geometry considerations, however, it was necessary to use an axle with a $2-11/16$ -inch internal diameter, which provides 5.67 square inches of flow area. This reduction in orifice area has a significant effect on the operating conditions of the high-flotation tire which was confirmed by the drop-test results.

Roller bearings are mounted in the stationary axle housing, and the axle is allowed to rotate with the tire. The axle is made of SAE 4135 steel hardened to 35 R_C,

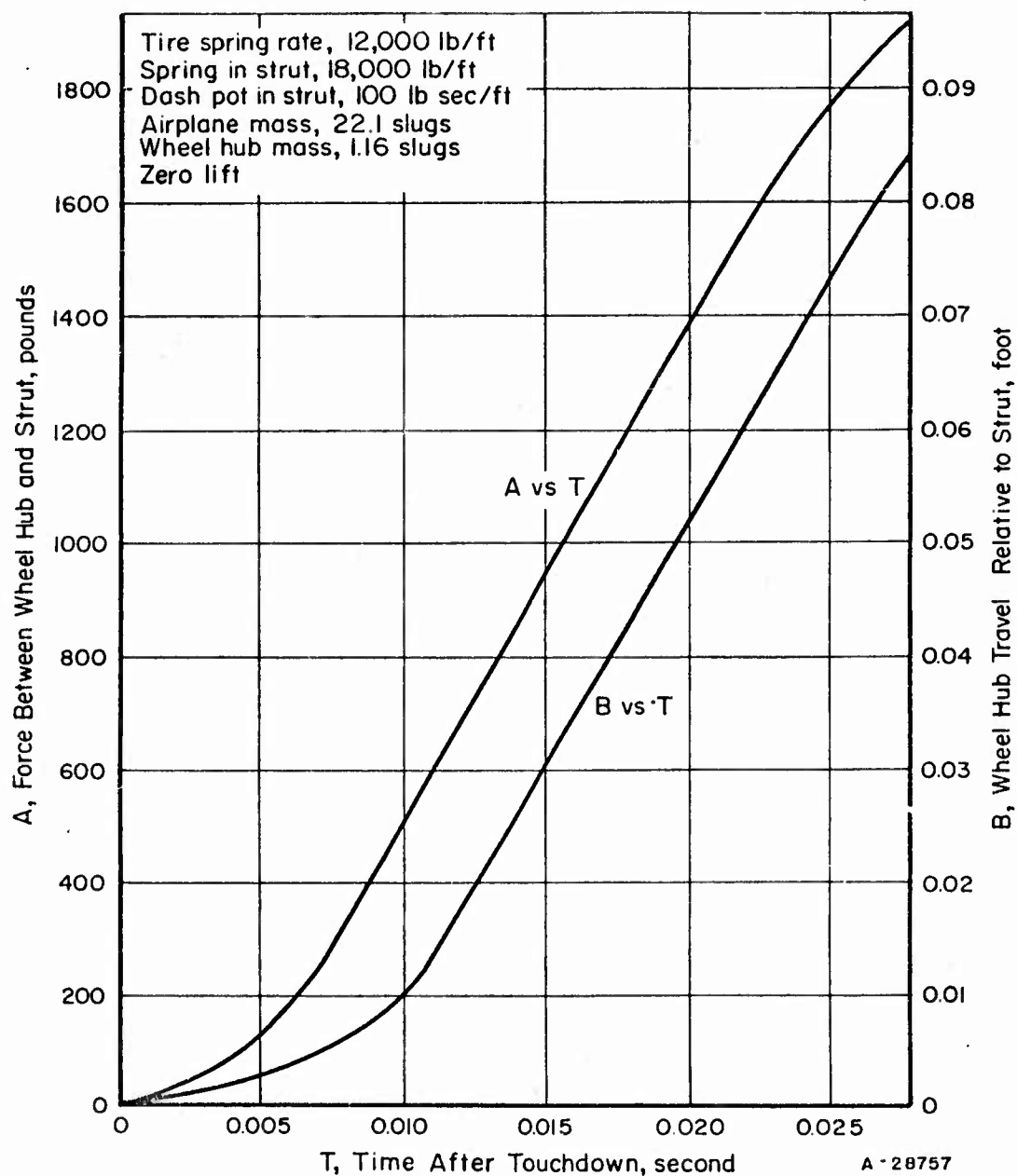
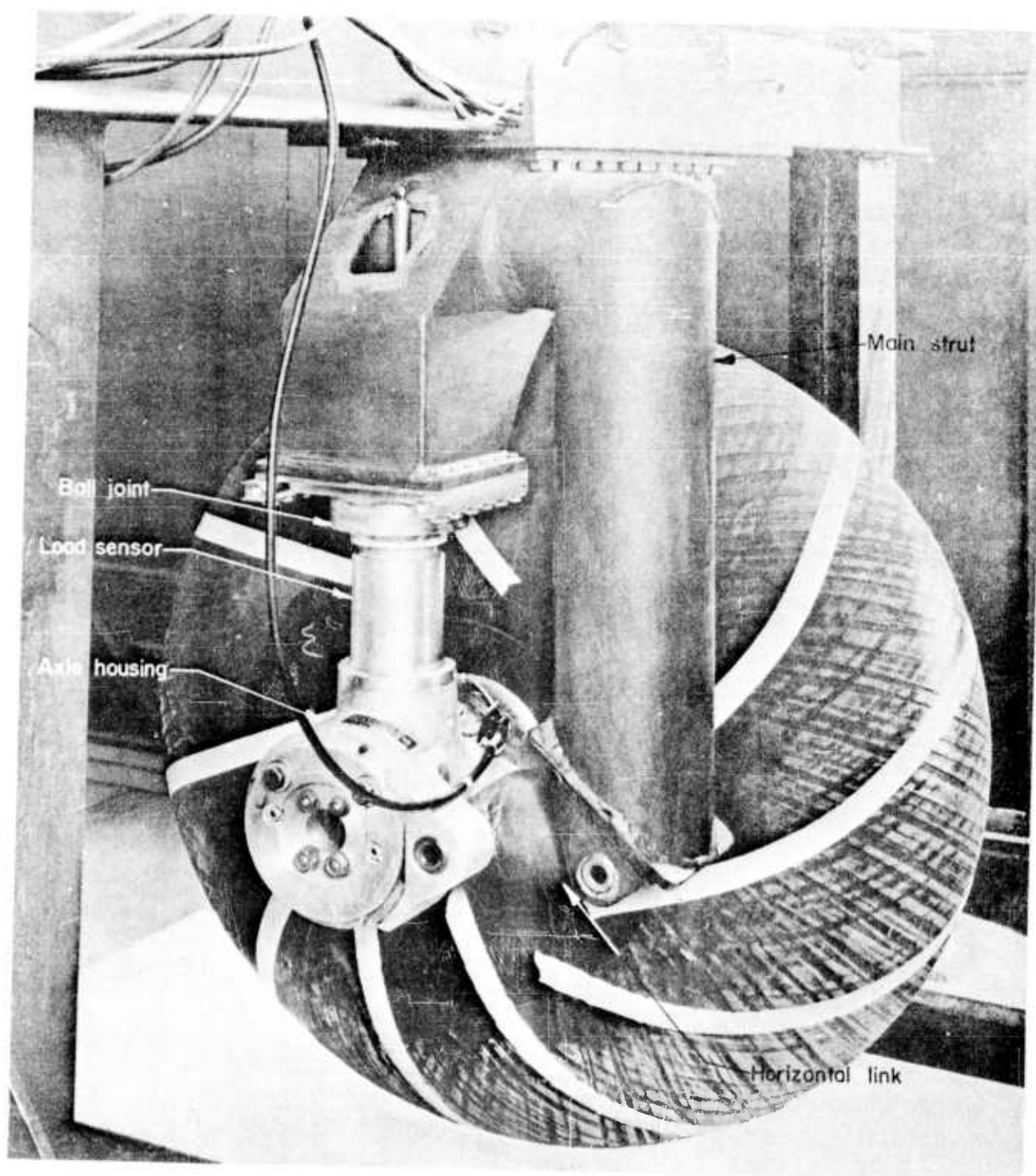


FIGURE 2. DYNAMIC RESPONSE OF WHEEL HUB DURING 8.4 FT/SEC LANDING



N50755

FIGURE 3. ASSEMBLED 750-POUND HIGH-FLotation LANDING GEAR
SHOWING LINKAGE ARRANGEMENT

BATTELLE MEMORIAL INSTITUTE

and the housing is an Almag 35 casting. The brake being used is an Auto Specialties 5 x 3-1/4 single-rotor brake which has been adapted to fit this particular installation.

Load Sensor

Figure 4 is a schematic sketch of the load-sensing strut which is being used in the 750-pound static load high-flotation landing-gear system. The unit has a stiff load-sensing spring mounted in series with a light energy-storage spring and an energy-absorbing dashpot which are mounted in parallel. Valve actuation is accomplished by means of a yoke-shaped bell crank which is mounted in the axle housing. A deflection of the load-sensing spring permits the bell-crank pushrod to move downward. This movement rotates the bell crank, which produces an axial movement of a ring that is mounted externally on the axle. This ring is connected to the valve pushrod by pins that pass through slots in the axle. The load-sensing strut functions in the following manner:

- (1) The vertical load on the landing gear is transmitted from the axle housing through the load-sensing spring to the piston assembly.
- (2) The deflection of the load-sensing spring under load actuates the yoke-shaped bell crank.
- (3) The load between the piston assembly and the strut is shared by the energy-storage spring and the dashpot.
- (4) After the dashpot reaches the end of its travel and bottoms, the major portion of the load is carried directly from the piston assembly to the strut. The energy-storage spring, however, continues to carry its portion of the load.

Since the load-sensing function is performed by the deflection of the load-sensing spring, this spring is the only component of the present load-sensing strut that is actually necessary for valve actuation. The energy-storage spring and the dashpot or "oleo" have been incorporated into the design, however, to obtain additional information as to how the high-flotation landing gear will function when installed in series with other forms of energy-storage or absorption devices. The first phase of the testing program was conducted with the energy-storage spring and the dashpot locked out of the system so that the energy dissipation characteristics of the high-flotation tire could be established. Tests are presently being conducted with the energy-storage spring and the dashpot installed, to determine their effect on the characteristics of the system.

Sleeve Valve

After an extensive investigation of possible valve configurations, it was decided that a sleeve valve would offer many advantages over other types of valves for bleeding air from the tire. It would not be loaded by the air pressure in the tire, and a small linear movement would permit several rows of ports to be opened, providing the characteristic of large valve area versus valve travel. By contouring the ports in the sleeves, it would be possible to experiment with various valve-area versus valve-stroke relationships.

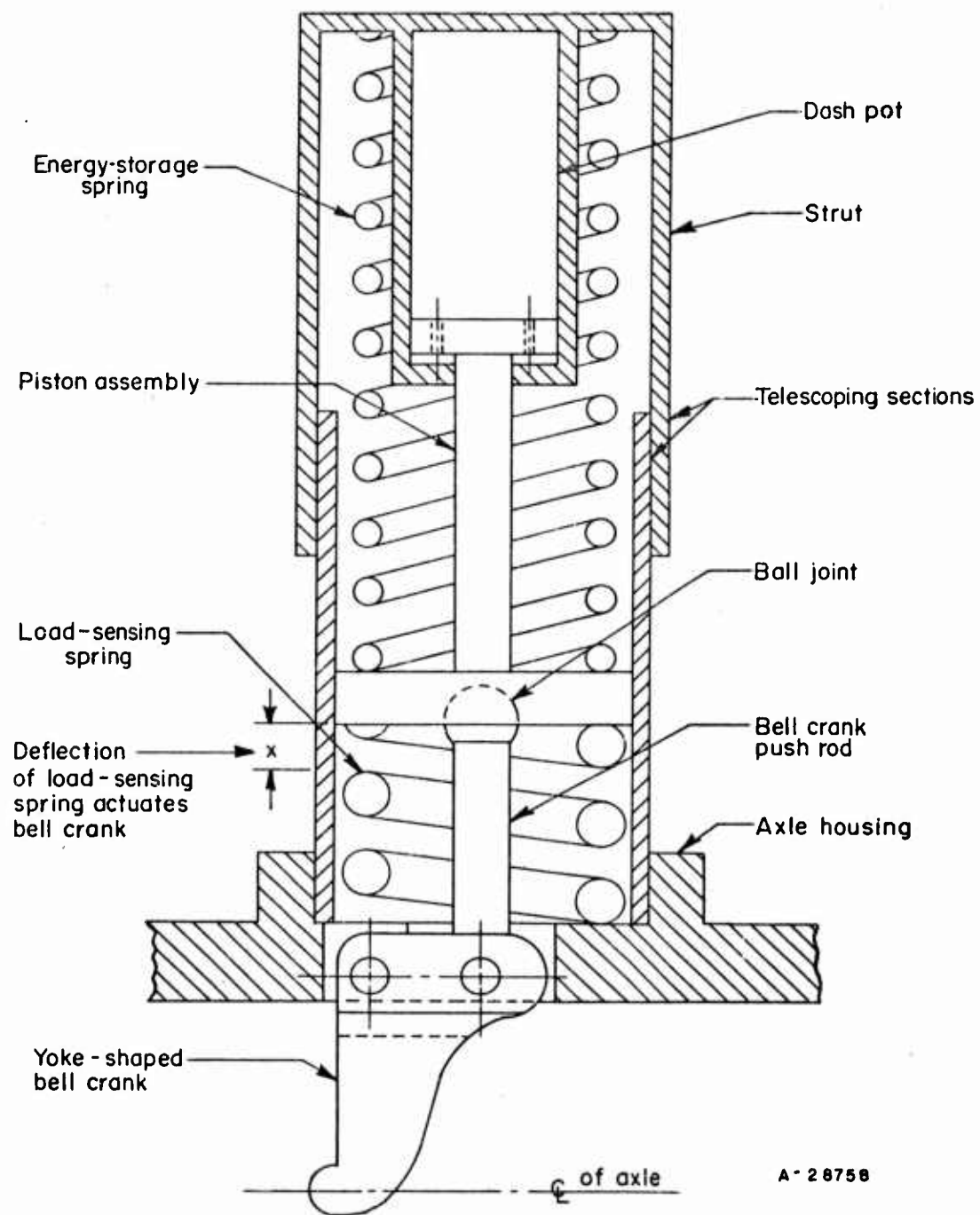


FIGURE 4. SCHEMATIC DRAWING OF LOAD-SENSING STRUT

The sleeve valve was designed to be internally mounted in the axle. Figure 5 is a photograph of the disassembled valve and a dummy axle. To prevent binding of the valve with axle deflections, the outer sleeve is flexibly supported by O-rings on the inside of the axle and, therefore, is not constrained to deflect with the axle. The inner sleeve is free to move axially in the flexibly supported outer sleeve. An analysis of the perforated cantilever axle showed that no prohibitive deflections should be encountered.

The total valve stroke from full open to full closed is $3/4$ inch. After reaching the full-closed position, however, the valve is allowed to travel another $1/4$ inch to aid in sealing. Thirty-four shaped ports are located in a double helix pattern on the sleeves. They have a total valve area of 6.7 square inches and the internal cross-sectional area of the internal sleeve is 4.4 square inches. The ports are so shaped that 30 per cent of the total valve area is exposed in the first 0.45 inch of valve travel. As the valve area then begins to increase much faster, the remaining 70 per cent of the valve area is exposed in the last 0.30 inch of valve travel.

Valve-Test Apparatus

To determine the characteristics of this sleeve valve, a laboratory test setup was constructed to measure the bleed-down rates of the valve as a function of port configuration, port area, and initial tire pressure. A 6.9 cubic foot tank, which has the same volume as the undeflected 34-inch-diameter tire, was used to simulate the tire. A dummy axle containing the sleeve valve was installed in the cover plate of the tank. Because of the high flow rates, steady static flow was not maintained. Instead, pressure-versus-time records were obtained while the air in the tank blew down through the sleeve valve.

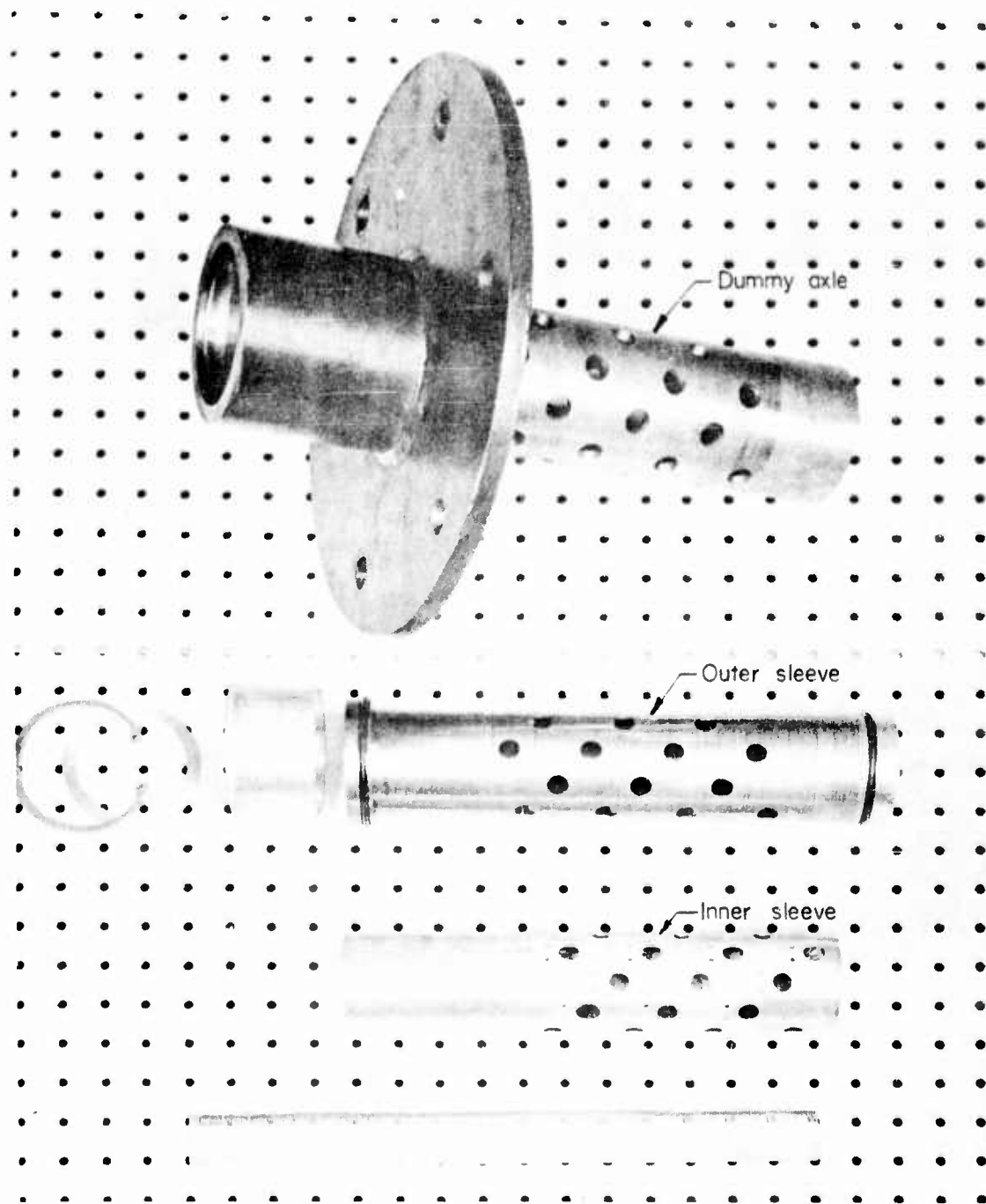
Sleeve-Valve Characteristics

Table 1 shows the times required to bleed the test tank from 17 to 2 psig at various degrees of valve opening and closure. These results show that leakage is a major problem with the sleeve valve. It requires only 6 seconds to bleed the tank from 17 to 2 psig when the valve is in the closed position and only 11 seconds when the leakage path is increased by moving the valve $1/4$ inch beyond the closed position. To reduce this high leakage rate, it would be necessary to hold extremely close tolerances on the sleeves and to make use of various coating techniques on the sealing surfaces. It was apparent, however, that even with extreme care in sleeve manufacture, the leakage rate would be excessive.

Redesigned Valve

To replace the original sleeve valve, a new valve configuration was conceived which is positively sealed in the closed position without the necessity of holding extremely close tolerances or using special valve-surface treatments. Figure 6 is a photograph of the disassembled valve and a dummy axle. Valve operation is as follows:

- (1) Air passes from the tire to the axle through 8 large ports.



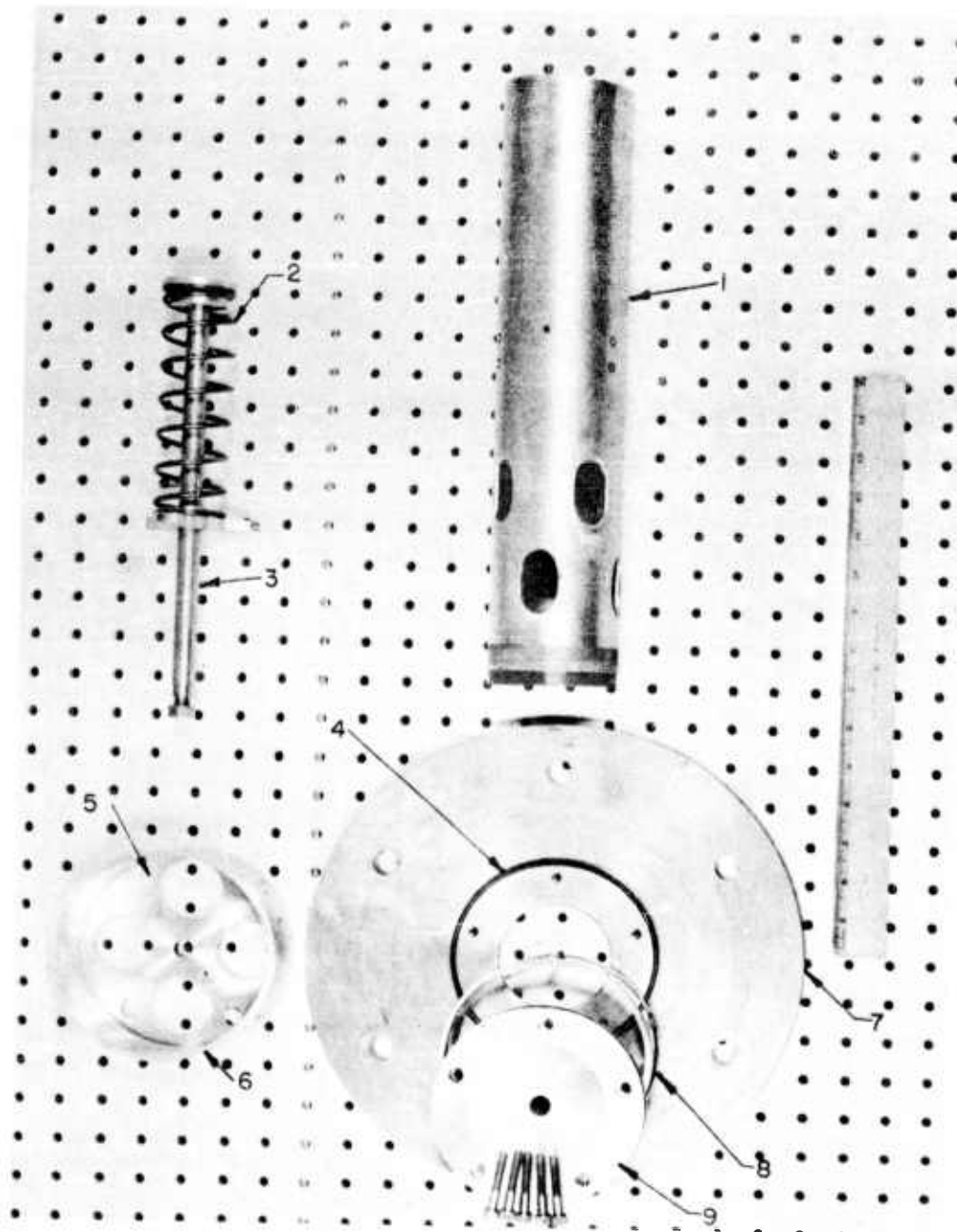
N50758

FIGURE 5, EXPERIMENTAL SLEEVE VALVE SHOWN DISASSEMBLED

TABLE 1. BLEED-DOWN RATES OF TIRE VALVES

| Fraction of Full Valve Area ^(a) , per cent | Fraction of Total Valve Stroke, per cent | Time Required to Bleed 6.9 Ft ³ Tank From 17 to 2 Psi, seconds |
|---|--|---|
| <u>Original Sleeve Valve</u> | | |
| 100 | 100 | 0.25 |
| 67 | 83 | 0.30 |
| 33 | 62 | 0.45 |
| 0 | 0 | 6.00 |
| 0 | -1/4-inch movement beyond port closure | 11.00 |
| <u>Present Valve Configuration</u> | | |
| 100 | 100 | 0.25 |
| 67 | 67 | 0.28 |
| 33 | 33 | 0.40 |
| 0 | 0 | ∞ |

(a) Total valve areas for original and present valves are 5.7 and 10.8 square inches, respectively. Axle areas for original and present configuration are 4.4 and 5.7 square inches, respectively.



N50757

- | | |
|---------------------|-------------------------------|
| 1. Dummy axle | 5. Valve end plate |
| 2. Valve spring | 6. Outboard sleeve |
| 3. Valve pushrod | 7. Dummy outboard tire flange |
| 4. Face-seal O-ring | 8. Valve-port cylinder |
| 9. Axle end plate | |

FIGURE 6. IMPROVED TIRE BLEED-DOWN VALVE SHOWN DISASSEMBLED

- (2) An axle end plate, which is contoured to turn the air in a radial direction is mounted on the outboard tire flange.
- (3) A replaceable programmed valve port cylinder is mounted between the axle end plate and the outboard tire flange.
- (4) Valve area is controlled by an outboard sleeve which is mounted on the outside of the programmed valve port cylinder and which is sealed in the closed position by one reciprocating and one face-seal O-ring.
- (5) The external sleeve is moved axially to uncover the valve ports by a pushrod which passes through the center of the axle end plate and which is sealed by a reciprocating O-ring. The pushrod is joined to the external sleeve by a light disk which is exposed to atmospheric pressure on both sides to prevent pressure loading of the valve.
- (6) The valve is spring loaded in the closed position.

The eight axle ports have a total area of 8.0 square inches. Since the sleeve valve was removed from the inside of the axle, the effective internal axle area was increased from 4.4 to 5.7 square inches. The valve stroke from full open to full closed remained at 3/4 of an inch and the maximum valve area, without programming, is 10.8 square inches. A spring which applies a force of 66 pounds in the full-open position and 55 pounds in the closed position is used to close the valve and to hold it tightly against the face seal.

Redesigned Valve Characteristics

The bleed-down times for this valve are also shown in Table 1. They compare favorably with those of the original sleeve valve even though the air is required to mushroom out at a 90-degree angle at the end of the axle. The air-turning resistance has been compensated for by using larger port and axle areas in the new design. When the valve is in the full-open position, it requires 0.25 second to bleed the tire from 17 psig to 2 psig. No measurable leakage was encountered when the valve was in the closed position. During recent test runs, the valve has been closing from the full-open to the full-closed position in approximately 13 milliseconds.

Pressure Sensor

A feature that was not called for in the analytical study specifications, but which is believed to be essential for satisfactory tire performance, is an overriding pressure control. Such a pressure control would have two main purposes. The first would be to insure a given minimum tire pressure by closing the valve whenever this minimum pressure is reached regardless of the load on the landing gear. The second purpose would be to permit reinflation of the tire to some maximum take-off pressure without danger of actuating the valve during take-off.

A pressure-sensing unit has been built within the axle of the high-flotation landing gear to accomplish both of the pressure-control functions. The present pressure sensor is designed to close the valve at a minimum tire pressure of 2 psig during a landing and to permit the tire to be reinflated to 11 psig for take-off without danger of valve actuation. It controls valve actuation by means of a spacer block which is located between two sections of the valve pushrod. When the spacer block is located between the two sections of valve pushrod, the resulting assembly has sufficient length to actuate the valve, but when the spacer block is removed from between the two sections, the resulting assembly does not have sufficient length to actuate the valve.

The method by which the spacer block is engaged and disengaged from the valve pushrod is shown in Figure 7. Operation of the unit is as follows:

- (1) The spacer block is guided by slots which are cut into a U-block, and is capable of moving axially with the valve pushrod assembly inside the axle.
- (2) The U-block is mounted on guide pins and is free to move transversely with respect to the axle.
- (3) The U-block is spring loaded to hold it in a position which will disengage the spacer block from the valve pushrod assembly.
- (4) Cam straps, which are mounted between rollers on the U-block and balance rollers, move axially and control the transverse position of the U-block.
- (5) The position of the cam straps is controlled by a piston which is loaded by tire pressure on one side and atmospheric pressure and a preset spring on the other side.
- (6) When the tire pressure force on the piston is sufficient to overcome the piston spring force and the axial component of the force imposed on the cam straps by the U-block springs, the piston will move to the right thus moving the U-block down, and with it moving the spacer block to the engaged position.
- (7) In the engaged position, the rollers on the U-block are seated on the horizontal section of the cam surface, and the U-block springs no longer impose an axial force on the cam straps.
- (8) When the tire pressure force on the piston drops below the piston spring force, the piston moves to the left and allows the disengaging springs to lift the U-block and the spacer block to the disengaged position.

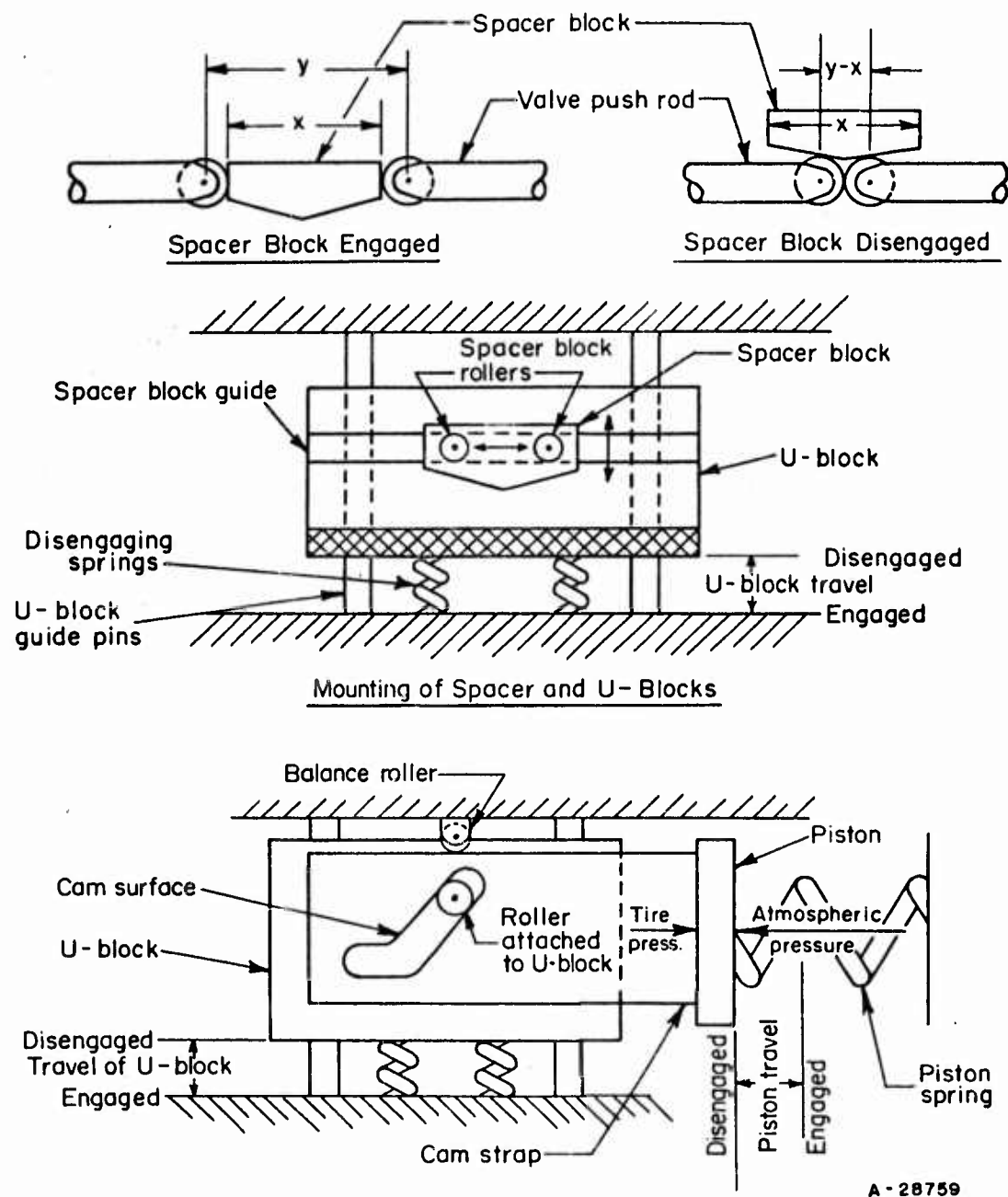


FIGURE 7. METHOD OF ENGAGING AND DISENGAGING SPACER BLOCK IN PRESSURE SENSOR

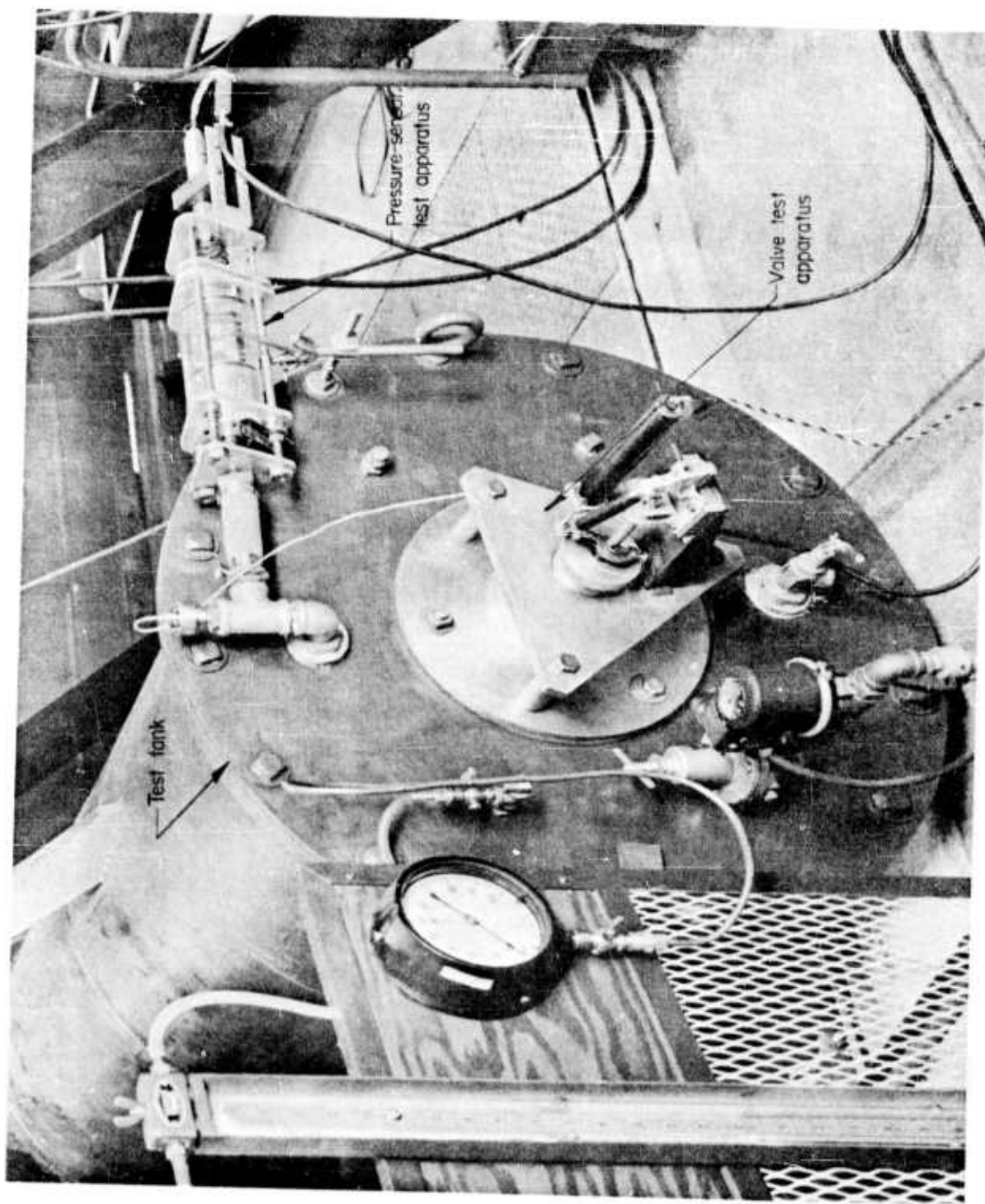
Pressure-Sensor Bench Testing and Characteristics

The pressure-sensing unit was extensively bench tested to determine its operating characteristics and reliability. It proved to be highly reliable under both static and dynamic conditions. The first series of tests were run under dynamic tire bleed-down conditions and static vibration conditions. These tests were conducted with the pressure-sensing unit connected to the valve test tank. Figure 8 is a picture of the test setup. Operation of the pressure-sensing unit was tested for all valve openings and pressure blow-down rates. The pressure at which the piston in the pressure-sensing unit began to move and the pressure at which the valve began to close were recorded. The pressure at which the piston began to move was extremely consistent. It remained between 2.75 and 3.0 psig at all blow-down rates. By the time the valve had started to close, the pressure had dropped to 2.2 psig for tests with full-valve opening, and to 2.4 psig for tests with the valve 1/3 open. Final tire pressure is dependent on the time required for valve closure. The engaging pressure during these tests varied from 11-1/2 to 12-1/2 psig.

To determine the effect of vibration on the sensitivity of the pressure-sensing unit, it was mounted on a M. B. Manufacturing Company Model C-3 vibrator table and allowed to bleed down from maximum tire pressure. Table 2 shows the effect of vibration loading on the pressure-sensor actuation pressure. The vibration loading was applied both axially and transversely. There was no appreciable change in the actuation pressure of the pressure-sensing unit when it was subjected to the various combinations of transverse loading, but axial vibrations did affect the actuation pressures slightly. An increase of 0.34 psig in actuation pressure was noted when an axial loading of 5 G's peak to peak at a frequency of 20 cps was applied to the pressure-sensing unit. Because of the low pressure of 2 to 3 psig, which would prevail during operation of the pressure sensor, it is doubtful that the soft tire will transmit axial loadings greater than those used in these tests.

TABLE 2. EFFECT OF VIBRATION ON PRESSURE-SENSOR
ACTUATION PRESSURE

| Acceleration Peak
to Peak, G's | Frequency,
cps | Actuation Pressure,
psig |
|---|-------------------|-----------------------------|
| <u>Excitation Perpendicular to Axle Center Line</u> | | |
| 0 | 0 | 3.09 |
| 10 | 20 | 3.00 |
| 10 | 100 | 3.00 |
| <u>Excitation Parallel to Axle Center Line</u> | | |
| 0 | 0 | 3.09 |
| 5 | 20 | 3.43 |
| 5 | 100 | 3.28 |



N48086

FIGURE 8. LABORATORY APPARATUS FOR EVALUATING TIRE BLEED-DOWN VALVE AND PRESSURE-SENSING UNIT

Rotary Seal

The air passage from the inflation-deflation system to the tire requires the use of two rotary seals between the rotary axle and the stationary axle housing. Because of space limitations, simplicity, and ease of application, large rotary O-ring seals are used. The rotary O-ring seals, which have a 1/16-inch-diameter cross section and a 90 durometer hardness, were installed according to the manufacturer's specifications. Before being incorporated into the design, however, they were laboratory tested under dynamic conditions.

During these tests two O-rings were mounted in a large stationary cylinder which represented the housing. A dummy axle, which was polished to 6 microinches rms, passed through the stationary cylinder and was rotated at speeds up to 1000 rpm. The section of the stationary cylinder between the two rotary O-rings was pressurized to 17 psig during the tests. To obtain satisfactory operation of the O-ring seals, it was found necessary to lubricate them with greases, such as Lubriplate No. 630AA, which are capable of operating at moderately elevated temperatures. Twenty 2-minute runs at an axle speed of 1000 rpm were completed with zero air leakage. The seals were allowed to cool between test runs. To reduce friction further and to decrease wear, the section of the axle in contact with the rotary seals has been chromium plated and polished to a 6-microinch rms finish.

Tire-Folding Provisions

Deflation and folding of the high-flotation tires after take-off are necessary that they will not require excessive space when they are retracted into the plane. Efforts to find the most satisfactory method of tire folding showed that the helical bellows method, which was recommended in the analytical study, offered the most promise. Early efforts to fold the tire into a helical bellows employed a mechanically applied torque, but the undistorted tire possesses extremely high torsional rigidity, and mechanical means of folding the tire would require excessively heavy equipment. It was found, however, that by drawing a vacuum in the tire, it could be induced to fold itself into a helical bellows.

Tire Modifications

Simply pulling a vacuum on the present tire geometry does not result in an acceptable folded tire package. Stiffening ribs must be applied to the tire to induce it to fold into a uniform symmetrical package. It is also necessary to start the tire folds mechanically at points midway between two adjoining ribs. Tests were conducted to determine the most satisfactory stiffening-rib pattern and to determine the necessary construction specifications to make a tire self-folding when a vacuum is drawn in it.

During the testing program, the stiffening ribs were cemented on the outer surface of a conventional 34-inch-diameter tire. Half-inch square, 50 durometer rubber strips were used as stiffening ribs, but they were not stiff enough to provide satisfactory tire folding. "B" size V-belts were used and produced satisfactory results. Experiments were carried out with variations in the stiffening-rib lead angle, the number of tire folds, and the distance between tire flanges. The helical stiffening

ribs were tested with lead angles of 0, 35, and 45 degrees. The most satisfactory results were obtained with a lead angle of 35 degrees. Six, seven, eight, ten, and fourteen stiffening ribs were used to determine the most desirable number of tire folds. With 10 and 14 ribs, it was found that the tire section between two adjoining ribs was too stiff to permit uniform creasing. The tire creased satisfactorily with eight ribs, although not quite so easily as with six or seven. Eight ribs permitted a slightly smaller final diameter than six or seven, however, and it was decided that this was the best number of ribs for this particular tire.

A more uniform outer diameter of the folded tire can be maintained by mounting circular stiffening ribs of a given diameter concentric with the axle on the side walls of the tire. The diameter of these stiffening ribs determines the final diameter of the folded tire. Tests indicate that the minimum diameter that can be successfully used for the side wall stiffening ribs in the 34-inch tire is 20 inches. The most satisfactory stiffening-rib configuration, therefore, consists of two circular ribs of 20-inch-diameter concentric with the axle and mounted on either side of the tire, and eight equally spaced helical ribs having a 35-degree lead angle. These ribs extend between the two circular side wall ribs. All ribs must be at least as stiff as a "B"-type V-belt. It is believed that such ribs could be molded into the tire during tire fabrication. Figure 9 shows pictures of the 34-inch-diameter tire in both the unfolded and folded conditions.

To start the creasing mechanically between the stiffening ribs, elastic cords were fastened to the interior of the tire midway between adjacent ribs. These cords were, in turn, fastened to a circular elastic cord, which was concentric with the axle, and thus provided a slight inward pull (4 pounds) on the section of the tire between the ribs. The elastic cords do not begin the creasing action until the tire pressure drops below 8 inches of water. It requires about 3 inches of water vacuum to start the folding action substantially and 12 inches of water vacuum to hold the tire in the completely folded position.

The tire-folding test axle was designed to hold the tire hubs out at their operational position until after the tire has been creased and one hub has started to rotate in relation to the other. By maintaining this distance between hubs, the initial tire creasing is substantially aided. After 10 degrees of rotation, the tire hubs are freed to move axially toward one another to further reduce the size of the folded tire. Total hub rotation during tire folding is about 90 degrees.

Tire-Flange Locking Mechanism

A positive lock on the inboard tire flange, which is allowed to move axially during the folding operation, is required to hold this flange in its operational position during a landing. Without such a locking mechanism, side loadings might unseat the flange during a landing with disastrous results. To accomplish this requirement, a method was devised to obtain positive locking of the inboard tire flange in its operational position during landings, but which will permit unlocking of the tire flange from the axle without any external actuation during the folding operation. This system, shown schematically in Figure 10, employs a pneumatic tube, inflated by tire pressure, to hold latches carried on the inboard tire flange in engagement with the axle. When the air pressure in the tire drops below a given value, the latches are disengaged by light springs and the tire is permitted to fold. The latches in the mechanism begin to disengage at 1-1/2 psig and are fully disengaged at 1/2 psig.



(a)

N50753



(b)

N50754

FIGURE 9. HIGH-FLOTATION TIRE WITH STIFFENING RIBS SHOWN
IN UNFOLDED AND FOLDED CONDITIONS

BATTELLE MEMORIAL INSTITUTE

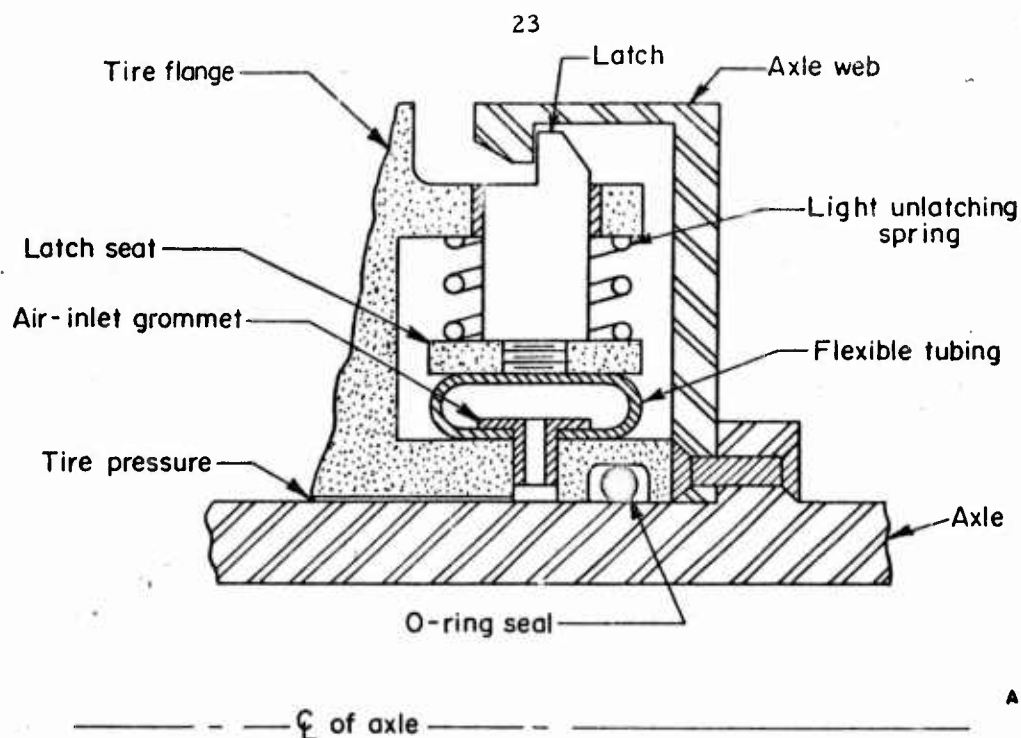


FIGURE 10. SCHEMATIC DRAWING OF TIRE-FLANGE LOCKING MECHANISM

Inflation-Deflation System

The use of the high-flotation tire necessitates an air-borne inflation-deflation system. This system must be capable of inflating the tire to its maximum initial inflation pressure (17 psig), making up for any possible tire leakage, and drawing a vacuum of 12 inches of water for tire folding. Fairly high capacity will be required to inflate and deflate the tire in short periods of time. The air-supply system used in the testing program is not designed for aircraft application. It is designed, however, to provide a minimum time for tire inflation. To inflate the tire, a solenoid valve, which is mounted between the tire and a large shop air line at 85 psig, is actuated for a given time interval. This time interval is sufficient to insure that the tire will reach, or slightly exceed, the desired initial tire pressure. In the event that the tire is slightly overinflated, it is bled down to the desired pressure. An adjustable pressure regulator is mounted in parallel with the timed solenoid valve. This regulator can be set to any desired pressure and furnishes air to replace losses due to any small amount of leakage. Tire deflation is accomplished by actuating a valve which connects the tire to a vacuum pump.

LANDING-GEAR DROP-TEST PROGRAM

Laboratory Drop-Test Apparatus

Component testing alone could not provide sufficient information to predict the operation of the complete high-flotation landing-gear system. Therefore, a drop-test apparatus was constructed at Battelle to perform preliminary tests on the assembled landing gear and to facilitate the acquisition of information on the necessary conditions for successful tire operation. During these preliminary tests, it was convenient to utilize the adjustability of the various components of the laboratory model high-flotation landing gear.

Drop-Tester Design

Figure 11 is a picture of the Battelle drop-test apparatus. It consists of a large four-bar linkage with a stationary vertical framework serving as one of the links. Two parallel arms are pinned to this frame one above the other. They guide the fourth link which is maintained in a vertical position. The distance between the pivot locations on the arms is 16 feet. To give the unit lateral stability, the arms are each constructed of two aluminum tubes which are spread 10 feet apart at the pivot location on the stationary frame. The high-flotation landing gear is mounted on the guided vertical link; in the remainder of this report this link will be referred to as the landing-gear carriage.

Landings can be made at any desired sinking speed by lifting the carriage to various heights with a crane and then dropping it. Since the guide arms cause the carriage to travel in an arc, the unit is designed to have the guide arms located in a horizontal position when the tire strikes the landing pad. This reduces to a minimum the effect of the circular path followed by the carriage.

The carriage has provisions for the attachment of additional weights. This makes it possible to carry out drop tests at various static loads. An emergency energy-absorption system is also provided for, in the event that the high-flotation tire fails to stop the vertical descent of the unit in the allowable tire deflection. The carriage has two outriggers mounted on either side of the high-flotation landing gear. These outriggers have pads on the bottom which strike piles of mounded sand when excessive tire deflections are encountered. Without this emergency stop serious damage could be done to the landing gear in the event of a blow-out or other serious malfunction. No such malfunction has yet occurred in the drop-testing program.

Drop-Tester Instrumentation

Evaluation of the landing-gear drop tests requires accurate knowledge of several important parameters. These parameters are:

- (1) Tire deflection
- (2) Acceleration

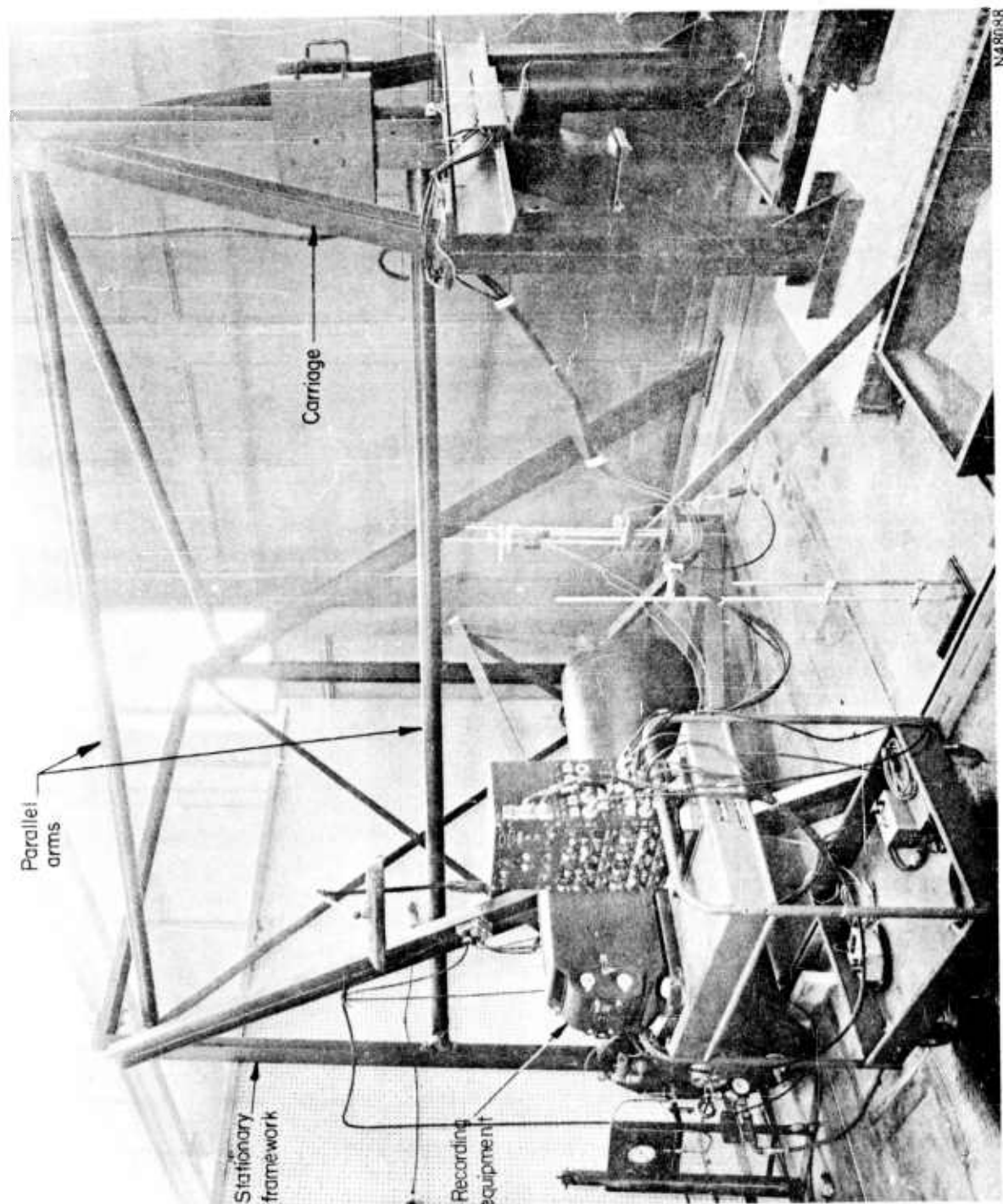


FIGURE 11. LANDING-GEAR DROP-TEST UNIT AND RECORDING INSTRUMENT

- (3) Tire air pressure
- (4) Valve position
- (5) Sinking speed
- (6) Time base.

A Consolidated 5-114 recording oscillograph was chosen to obtain the required information because of its excellent speed and sensitivity characteristics as well as on the basis of availability and adaptability. It is a high-speed, photographic, 18-channel recorder. Timing mark generation, automatic record numbering, and trace identification are self-contained features. A wide range of recording speeds and interchangeable galvanometers provide flexibility for special recording applications. A chart drive speed of 28.8 inches per second was selected for the landing-gear tests.

Because the travel of the landing-gear carriage is several times greater than the range of displacement transducers currently available, a lever system is used to scale down the carriage motion. This lever system consists of two links, one of which is pinned to the landing pad and the other of which is pinned to the carriage. The two links are then pinned together to form a scissors. The carriage displacement can be scaled down to any desired degree by mounting the pickup between the two links at various distances from the common pivot point. This scaled-down motion drives the slider of a linear potentiometer connected in a d-c bridge circuit to produce a signal proportional to carriage position.

Vertical acceleration forces encountered by the carriage are monitored by an accelerometer fastened to the carriage frame over the tire. Air pressure in the tire is measured by means of a variable-resistance pressure transducer. This pressure pickup is mounted inside the tire. Atmospheric reference pressure and lead wires pass through a tube which replaces one of the tire-flange retaining bolts. To provide an indication of valve position on the recording, a linear variable differential transformer (LVDT) is used to monitor the position of the valve. The recorder automatically provides a time base by marking the recording every one-hundredth second. Sinking speed is obtained by integrating the acceleration-time curve on the recording. Table 3 lists all the instrumentation equipment used along with information as to range, response, and sensitivity.

Drop-Test Conditions

Extensive drop testing of the assembled unit was carried out using the Battelle facility. During these tests the static load, initial tire pressure, sinking speed, and valve area were varied to determine their effects on the landing operation. Drop tests were carried out with static loads of 780 and 990 pounds. Sinking speeds ranging from 2-1/2 to 8-1/4 ft/sec were used in the 780-pound static load tests, and from 2-1/2 to 7-3/8 ft/sec in the 990-pound static load tests. Initial tire pressures were varied from 8 to 17 psig, and three different valve configurations were used. Valves A and B are similar in that they both have directly proportional valve area versus valve stroke characteristics. Valve A, however, has a larger magnitude of total area than Valve B.

TABLE 3. INSTRUMENTATION EQUIPMENT ON BATTELLE DROP TESTER

| Function | Transducer | Range | Amplifier | Galvanometer |
|---|---|--------------|-----------|--------------|
| 1. Displacement | Gianinni 8620-A Rectilinear potentiometer | 4 inch | None | 7-338 |
| 2. Acceleration | Statham C-15-350 Accelerometer | ± 15 G | 1-113 B | 7-323 |
| 3. Tire air pressure | CEC 4-311 Pressure pickup | 0-100 psi | 1-113 B | 7-323 |
| 4. Valve position | Schaevitz 1000-SL LVDT | ± 1 inch | 1-113 B | 7-323 |
| Amplifier - Power Supply | | | | |
| Consolidated Electrodynamics Corp. Type 5-114 | | | | |
| Channels available: 18 | | | | |
| Chart speed used: 28.8 in./sec | | | | |
| Timing marks: 0.01 sec | | | | |
| Galvanometers: 7-323 | | | | |
| $\pm 5\%$ Freq. range: 0-600 cps | | | | |
| Sensitivity: 2.56 volts/inch | | | | |
| 7-338 | | | | |
| 0-125 cps | | | | |
| 8.4 millivolts/inch | | | | |
| Application: Acceleration | | | | |
| Tire pressure | | | | |
| Valve position | | | | |
| Tire displacement | | | | |

Amplifier - Power Supply

Recording Oscillograph

Consolidated Electrodynamics Corp.

Amplifier System D

Type 1-113 B Carrier amplifier

Carrier frequency: 3000 cps

Frequency response: $\pm 2\%$, 0-600 cps

Maximum sensitivity: 1-mv input produces full-scale output

Linearity: $\pm 2\%$ between 0 and full scale, 0-600 cps

Consolidated Electrodynamics Corp. Type 5-114

Channels available: 18

Chart speed used: 28.8 in./sec

Timing marks: 0.01 sec

Galvanometers: 7-323

 $\pm 5\%$ Freq. range: 0-600 cps

Sensitivity: 2.56 volts/inch

7-338

0-125 cps

8.4 millivolts/inch

Application: Acceleration

Tire pressure

Valve position

Tire displacement

Valve C is programmed so that the rate of valve-area opening is low during the first part, but high during the last part of the valve stroke. All three valves began to open when the load factor reached 0.75 and were full open when the load factor reached 1.5 for a static load of 780 pounds. A description of the three valves is as follows:

- A. The area of Valve A increases at the rate of $14.4 \text{ in.}^2/\text{inch stroke}$ and for a $3/4$ -inch stroke has a total area of 10.8 square inches.
- B. The area of Valve B increases at the rate of $8.7 \text{ in.}^2/\text{inch stroke}$ and for a $3/4$ -inch stroke has a total area of 6.5 square inches.
- C. The area of Valve C increases at the rate of $5.8 \text{ in.}^2/\text{inch stroke}$ for the first $5/16$ inch of valve stroke and at the rate of $14.4 \text{ in.}^2/\text{inch stroke}$ for the last $7/16$ inch of valve stroke. The total area for a $3/4$ -inch stroke is 8.1 square inches.

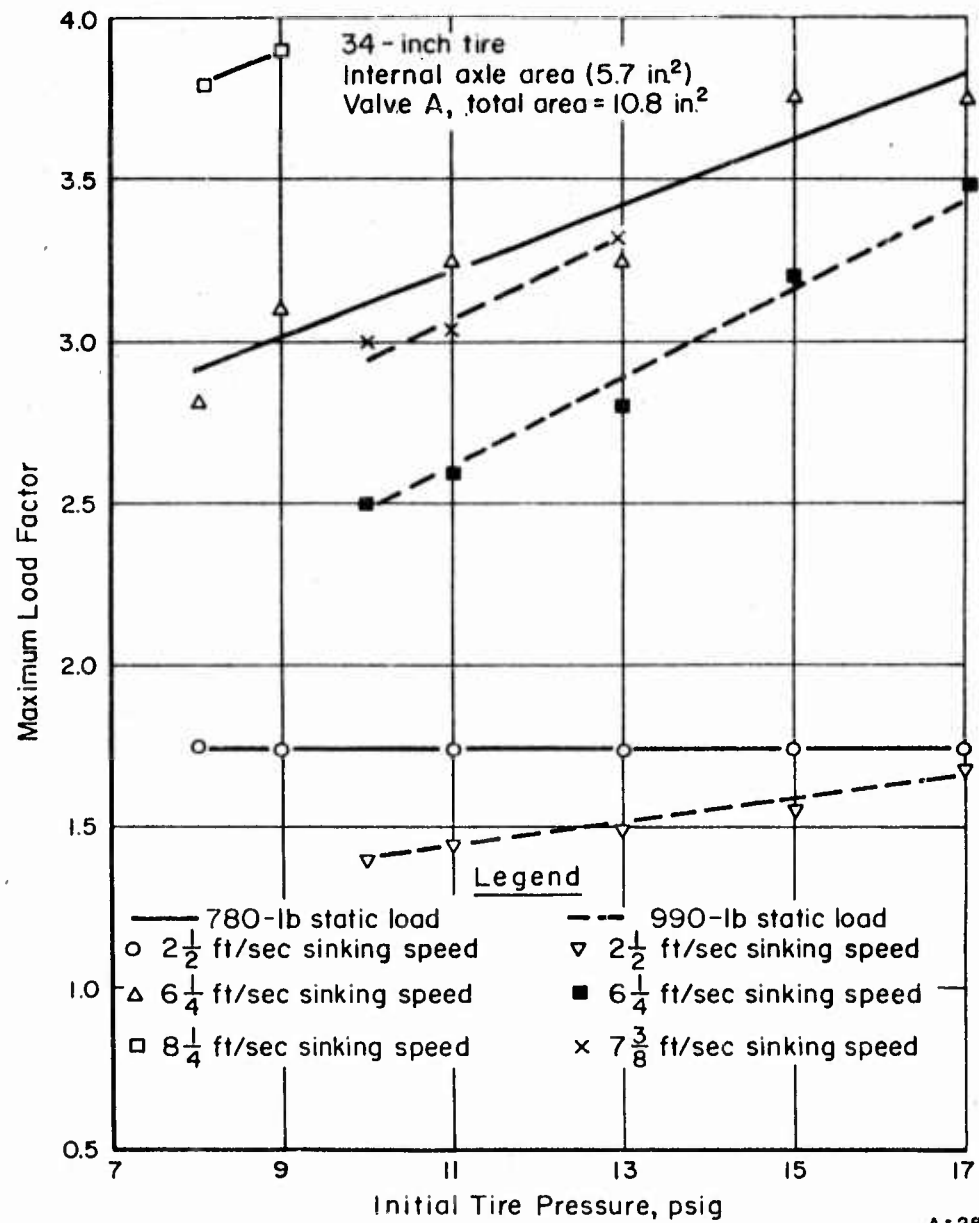
Drop-Test Results

The first drop tests were made with the recommended initial tire pressure of 17 psig. The results of these tests were not satisfactory and indicated that the bleeding of air from the tire was not taking place fast enough to prevent the load factor from becoming excessive. With Valve A, the maximum load factor for a static load of 780 pounds and a sinking speed of $6\text{-}1/4 \text{ ft/sec}$ reached 3.75. The impulse encountered during these early landings was so large that the tire often bounced back into the air.

Effect of Initial Tire Pressure on Maximum Load Factor

In an effort to reduce the magnitude of the maximum load factor and impulse, lower initial tire pressures were used. Figure 12 shows a graph of maximum load factors versus initial tire pressure obtained with Valve A for various combinations of sinking speed and static load. These results show that at the higher sinking speeds the maximum load factor was substantially reduced by employing lower initial tire pressures. In the case of the landing with a 780-pound static load and a sinking speed of $6\text{-}1/4 \text{ ft/sec}$, the maximum load factor was reduced from 3.75 to 2.80 when the initial tire pressure was reduced from 17 to 8 psig. The tire did not bounce in the 8-psig landing, and very little oscillation was observed in the system. A practical minimum pressure, in this case 8 psig, was reached, however, below which successful higher sinking speed landings were not possible because the tire was no longer capable of supplying a large enough impulse to stop the descent of the plane in the available tire deflection.

At the lower sinking speeds initial tire pressure had little effect on the maximum load factor because there was much more time available to bleed air from the tire. The graph shows that, for landings at a sinking speed of $2\text{-}1/2 \text{ ft/sec}$ and a static load of 780 pounds, the maximum load factor remained fairly constant at 1.75. The maximum load factor for low-sinking-speed landings with a static load of 990 pounds was slightly reduced by a reduction in the initial tire pressure. By reducing the initial tire pressure from 17 to 11 psig in the landings made with Valve A at a sinking speed of $2\text{-}1/2 \text{ ft/sec}$ and a static load of 990 pounds, the maximum load factor was reduced from 1.7 to 1.45.



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FIGURE 12. RELATION OF MAXIMUM LOAD FACTOR TO INITIAL TIRE PRESSURE

At any given initial tire pressure and sinking speed, the maximum load factor was less for the 990-pound static load than for the 780-pound static load landings. This was to be expected, since for any given load factor the 990-pound static load requires a higher force (and thus a larger tire deflection for any given tire pressure) than the 780-pound static load. This larger required tire deflection allows the tire more time to bleed down and thus reduces the maximum load factor.

Effect of Valve Area and Programming on Maximum Load Factor

Table 4 shows the effect of valve area and programming on the maximum load factor. The maximum load factor under any given conditions of static load, initial tire pressure, and sinking speed was slightly less for tests conducted with Valve A than for those conducted with Valve B. This difference varied from around 0.05 to 0.30 for sinking speeds of 2-1/2 and 7-3/8 ft/sec, respectively, in the 780-pound static-load tests. It was even smaller in the 990-pound static load tests varying from 0 in some cases to a maximum of 0.20 at an initial tire pressure of 11 psig and a sinking speed of 6-1/4 ft/sec. Since Valve A has a total area of 10.8 square inches and Valve B has a total area of only 6.5 square inches, it would seem that the difference in maximum load factors obtained with the two valves should have been larger than those which were recorded. The fact that the maximum load factor reached when using Valve B is only slightly larger than that reached when using Valve A indicates that the main limiting restriction to air flow from the tire is the internal axle area of 5.7 square inches, which is identical for both valves.

Programming of the valve area, as was done in Valve C, to have a slow rate of area increase during the first part and a fast rate of area increase during the last part of the valve stroke had a beneficial effect on the maximum load factor for tests with the 780-pound static load at low initial tire pressures and/or low sinking speeds. For 780-pound static load tests with an initial tire pressure of 17 psig, the maximum load factor obtained with Valve C was not lower than that obtained with Valve A at any sinking speed, but when the initial tire pressure was reduced to 9 psig the maximum load factor obtained with Valve C was less than that obtained with Valve A at sinking speeds up to 6-1/4 ft/sec. It is believed that this beneficial effect could be extended to the higher initial tire pressures and sinking speeds if the available axle area were larger.

At present the valve immediately opens to the full-open position for all tests at high initial pressure and/or high sinking speeds. Programming at these conditions has little effect since it merely reduces the amount of total valve area that could be exposed in the full-open position. At the lower initial tire pressures and/or sinking speeds, programming improves the tire performance because the valve is operating in the programmed portion of the stroke and can more closely regulate the flow of air from the tire.

The maximum load factor of landings conducted with a static load of 990 pounds did not vary substantially between tests made with Valves A and C. One reason for this is that it requires a larger change in force to result in a given change in load factor for landings made at higher static loads. Another reason is that in the 990-pound static-load tests the valve began to open at a load factor of 0.60 and was full open at a

TABLE 4. EFFECT OF VALVE AREA AND PROGRAMMING
ON MAXIMUM LOAD FACTOR

| Initial Tire Pressure,
psig | Aircraft Sinking Speed,
ft/sec | Maximum Load Factor | | |
|----------------------------------|-----------------------------------|---------------------|---------|---------|
| | | Valve A | Valve B | Valve C |
| <u>Static Load of 780 Pounds</u> | | | | |
| 17 | 2-1/2 | 1.75 | 1.80 | 1.75 |
| | 4-3/4 | 3.05 | 3.15 | 3.10 |
| | 6-1/4 | 3.75 | 3.95 | 3.85 |
| 11 | 2-1/2 | 1.75 | 1.80 | 1.65 |
| | 6-1/4 | 3.30 | 3.40 | 3.15 |
| | 7-3/8 | 3.50 | 3.80 | 3.70 |
| 9 | 2-1/2 | 1.75 | 1.80 | 1.65 |
| | 6-1/4 | 3.10 | 3.20 | 2.85 |
| | 7-3/8 | 3.40 | 3.70 | 3.40 |
| <u>Static Load of 990 Pounds</u> | | | | |
| 17 | 2-1/2 | 1.70 | 1.70 | 1.75 |
| | 4-3/4 | 2.65 | 2.75 | 2.75 |
| | 6-1/4 | 3.35 | 3.35 | 3.35 |
| 11 | 2-1/2 | 1.45 | 1.60 | 1.50 |
| | 4-3/4 | 2.15 | 2.30 | 2.15 |
| | 6-1/4 | 2.60 | 2.80 | 2.70 |

Constant axle area of 5.7 in.², total valve stroke = 3/4 in.

Valve A - Valve area increases at rate of $\frac{14.4 \text{ in.}^2}{\text{inch valve stroke}}$

Valve B - Valve area increases at rate of $\frac{8.7 \text{ in.}^2}{\text{inch valve stroke}}$

Valve C - Valve area increases at rate of $\frac{5.8 \text{ in.}^2}{\text{inch valve stroke}}$

For first 5/16 inch of valve stroke and $\frac{14.4 \text{ in.}^2}{\text{inch valve stroke}}$ for last 7/16 inch of valve stroke.

load factor of 1.15. This reduced the time in which the valve was operating in the programmed portion of the stroke. Therefore, the maximum load factors of the landings made with the 990-pound static load were not so significantly affected by valve programming as those made with a 780-pound static load.

Optimum Operating Conditions and Range of Sinking Speeds

The highest sinking speed at which the unit was operated was 8-1/4 ft/sec. This sinking speed was attained in a series of drop tests that were made with a static load of 780 pounds, an initial tire pressure of 8 psig, and Valve A. Landings at all sinking speeds from 2-1/2 ft/sec to 8-1/4 ft/sec were successful under these conditions. Figures 13, 14, and 15 show the landing dynamic characteristics of the 34-inch-diameter high-flotation tire for these landings at sinking speeds of 2-1/2, 6-1/4, and 8-1/4 ft/sec, respectively. Figure 15 shows that the maximum load factor for the 8-1/4 ft/sec landing was 3.8, which is below the allowable design maximum of 4.0. The oscillation of the tire after valve operation, which is dependent on the energy remaining in the system, varied from around 1 inch peak-to-peak at the low sinking speeds to around 2 inches peak-to-peak at the higher sinking speeds.

Slightly higher initial tire pressure was required to give the best performance with the 990-pound static load. With an initial tire pressure of 10 psig, a static load of 990 pounds, and Valve A, the maximum load factor varied from 1.4 at a sinking speed of 2-1/2 ft/sec to 3.0 at a sinking speed of 7-3/8 ft/sec. The tire oscillation after these tests was around 1 inch peak-to-peak at all sinking speeds from 2-1/2 to 7-3/8 ft/sec.

Energy-Dissipation Capability of the High-Flotation Tire

Drop tests were made under identical conditions with and without valve actuation so that it would be possible to compare the two and determine the effectiveness of the high-flotation tire's energy dissipation capabilities. Figure 16 shows the dynamic characteristics of the 34-inch-diameter tire for a landing with a static load of 990 pounds, Valve A, an initial tire pressure of 10 psig, and a sinking speed of 7-3/8 ft/sec, but without valve actuation. Figure 17 shows the dynamic characteristics of a landing under the same conditions except that the valve is actuated.

By actuating the valve and bleeding air from the high-flotation tire, the maximum load factor was reduced from 4.55 in the landing with no valve actuation to 3.00. The landing made without valve actuation was unsuccessful: the tire bounced completely off the landing pad to a point just slightly below its original drop position. Almost zero energy was dissipated during the landing operation. The opposite was true, however, in the landing made with valve actuation. Almost all of the impact energy was dissipated by bleeding air from the high-flotation tire. It did not bounce, and only a 1-inch peak-to-peak oscillation remained in the system after valve actuation.

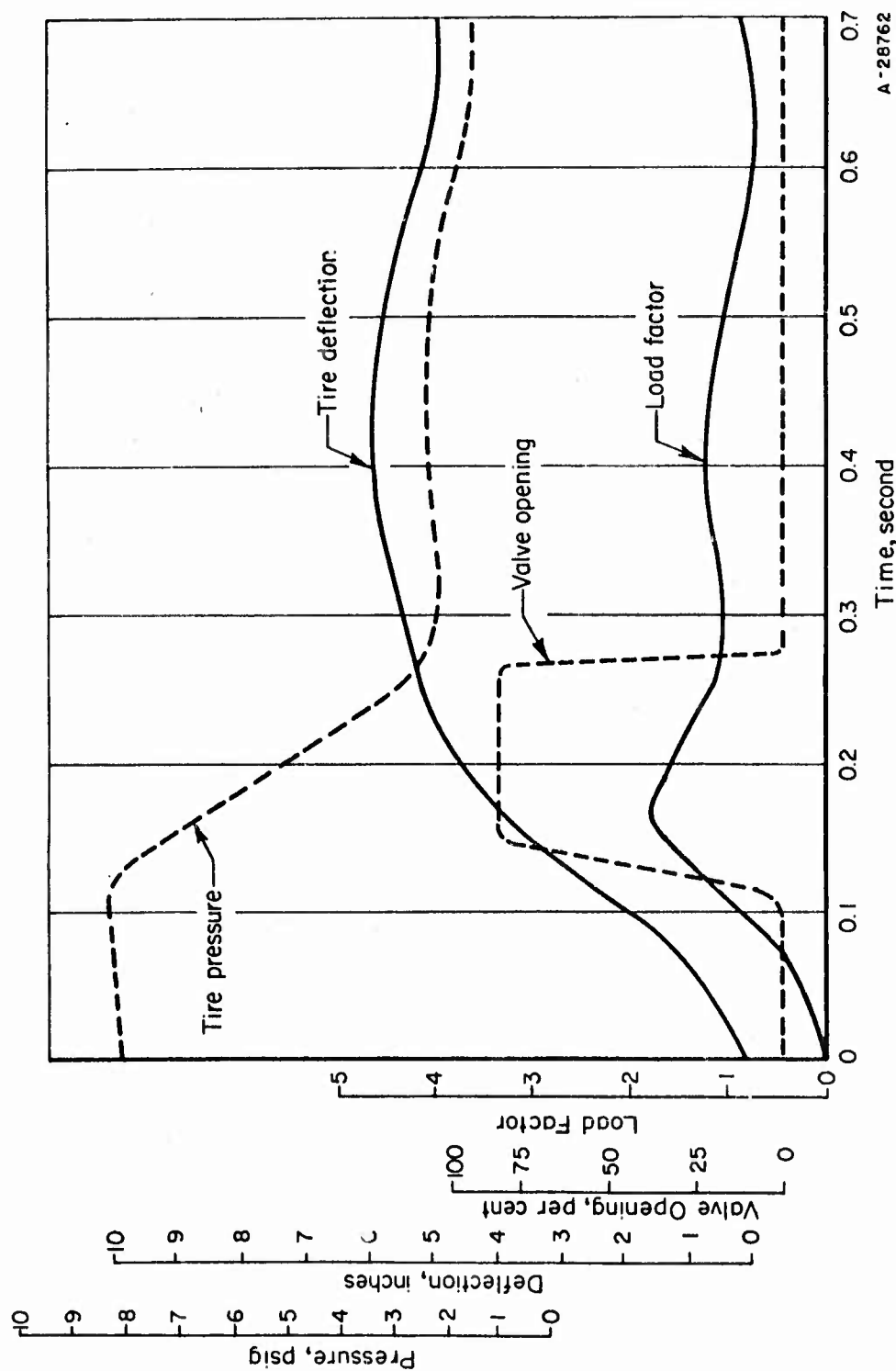
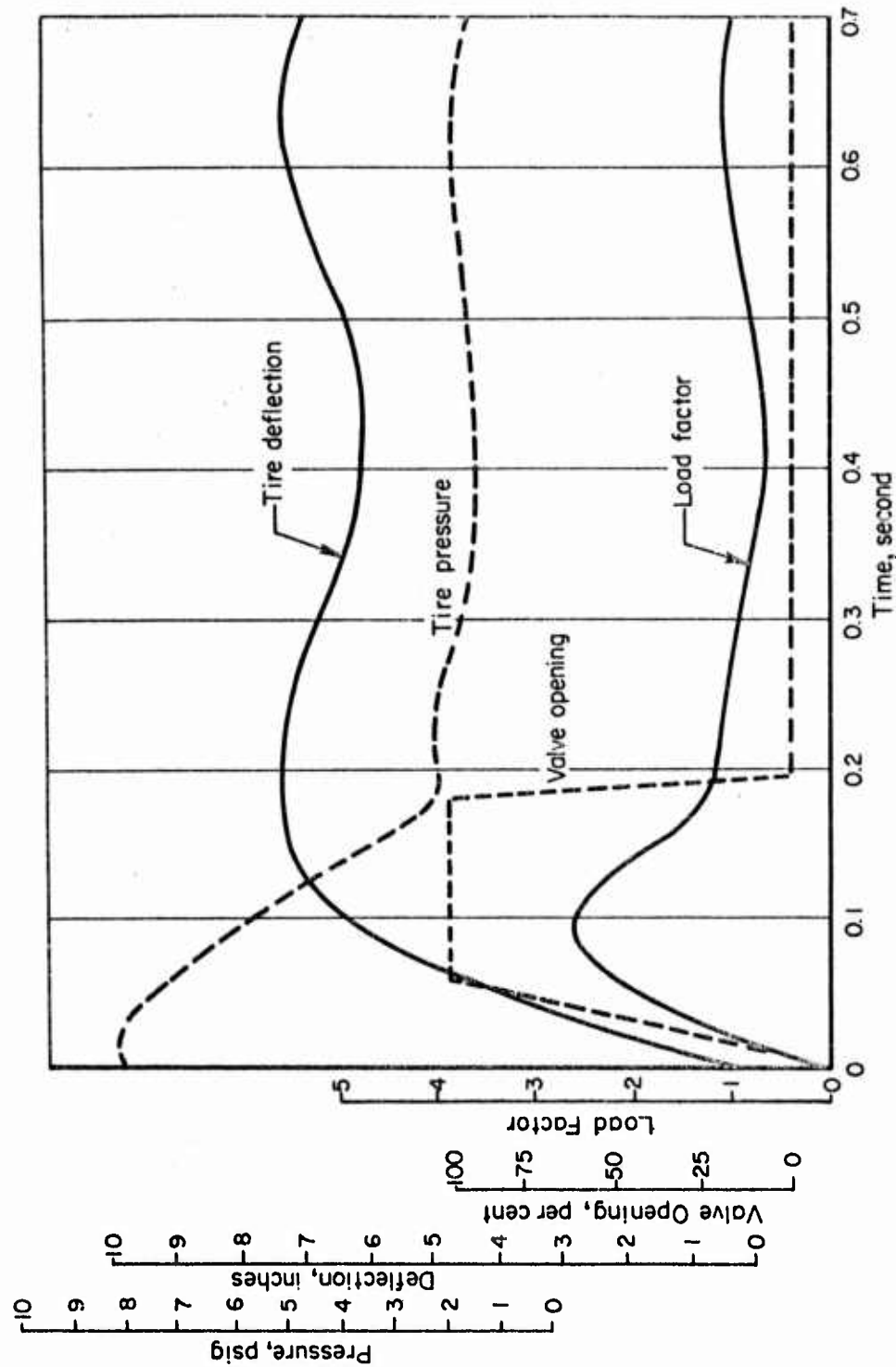


FIGURE 13. LANDING DYNAMICS OF A 34-INCH-DIAMETER HIGH-FLOTATION TIRE WITH AN INITIAL TIRE PRESSURE OF 8 PSIG, A STATIC LOAD OF 780 POUNDS, AND VALVE A AT SINKING SPEED OF 2-1/2 FT/SEC

Initial inflation pressure, 1152 lb/ft². Internal axle area, 0.04 ft² (5.7 in.²).



A - 28763

FIGURE 14. LANDING DYNAMICS OF A 34-INCH-DIAMETER HIGH-FLOTATION TIRE WITH AN INITIAL TIRE PRESSURE OF 8 PSIG, A STATIC LOAD OF 780 POUNDS, AND VALVE A AT A SINKING SPEED OF 6-1/4 FT/SEC

Initial inflation pressure, 1152 lb/ft². Internal axle area, 0.04 ft² (5.7 in.²).

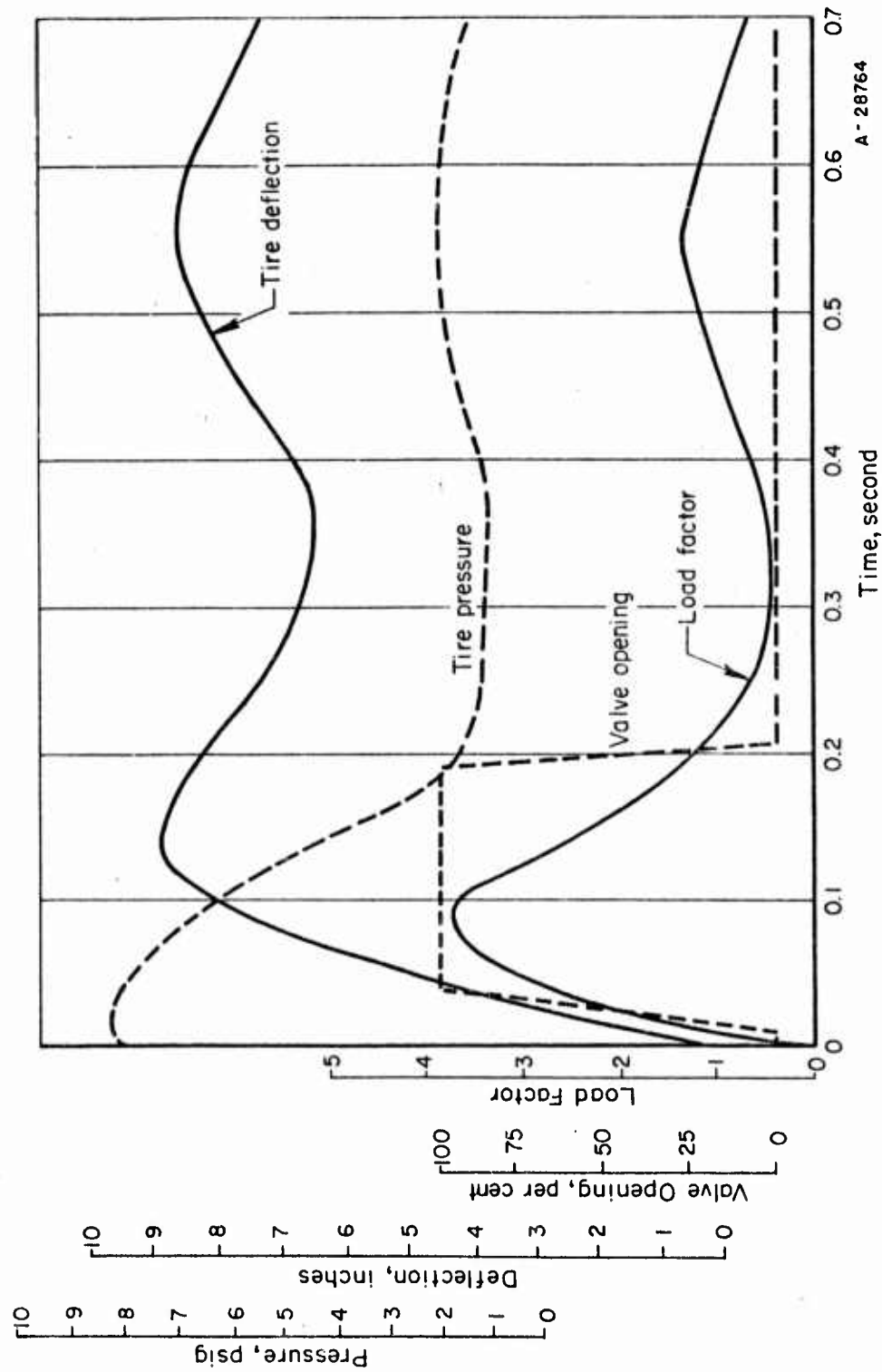


FIGURE 15. LANDING DYNAMIC OF A 34-INCH-DIAMETER HIGH-FLotation TIRE WITH AN INITIAL TIRE PRES-
SURE OF 8 PSIG, A STATIC LOAD OF 780 POUNDS, AND VALVE A AT A SINKING SPEED OF 8-1/4
FT/SEC

Initial inflation pressure, 1152 lb/ft². Internal axle area, 0.04 ft² (5.7 in.²).

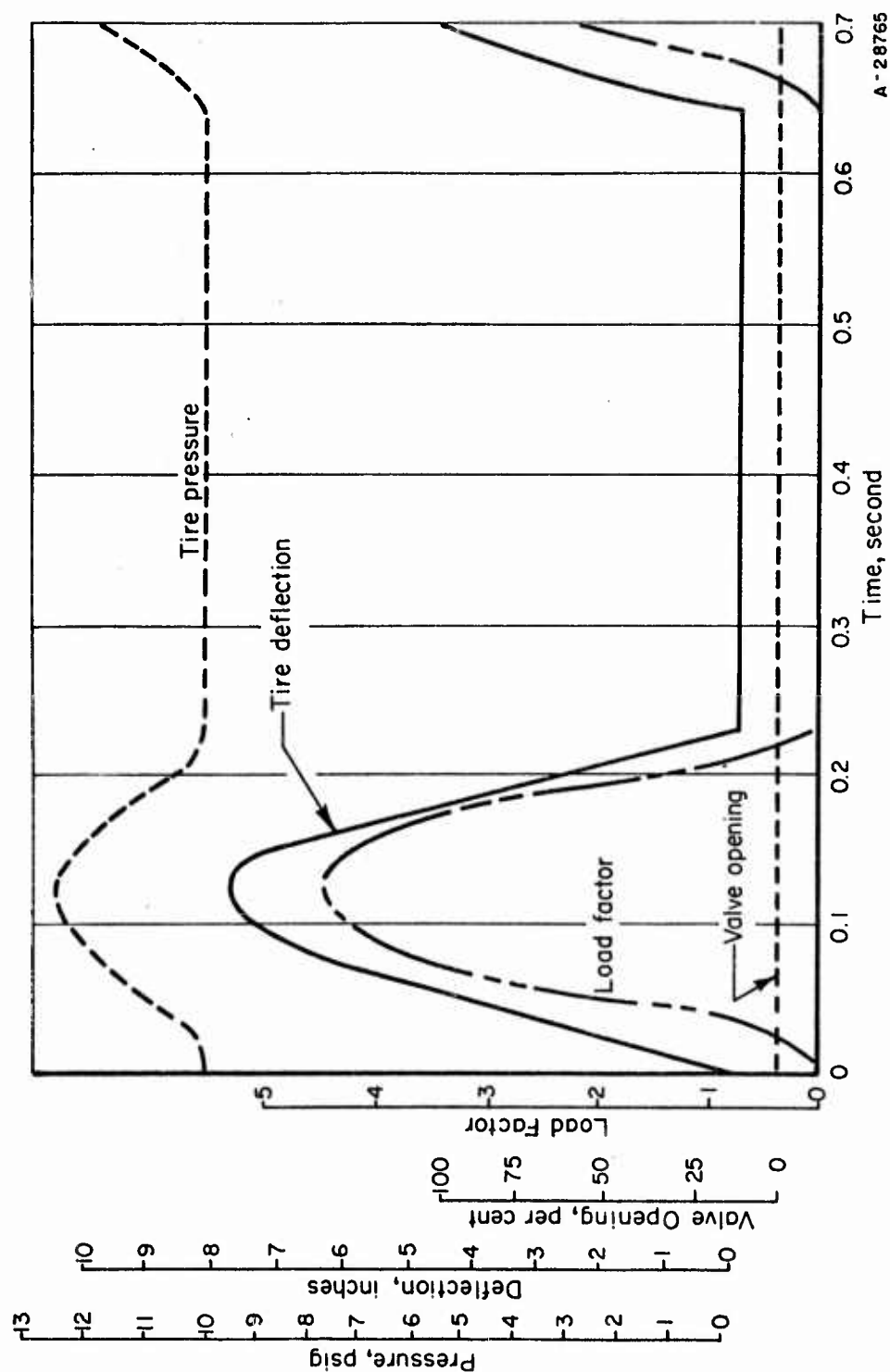
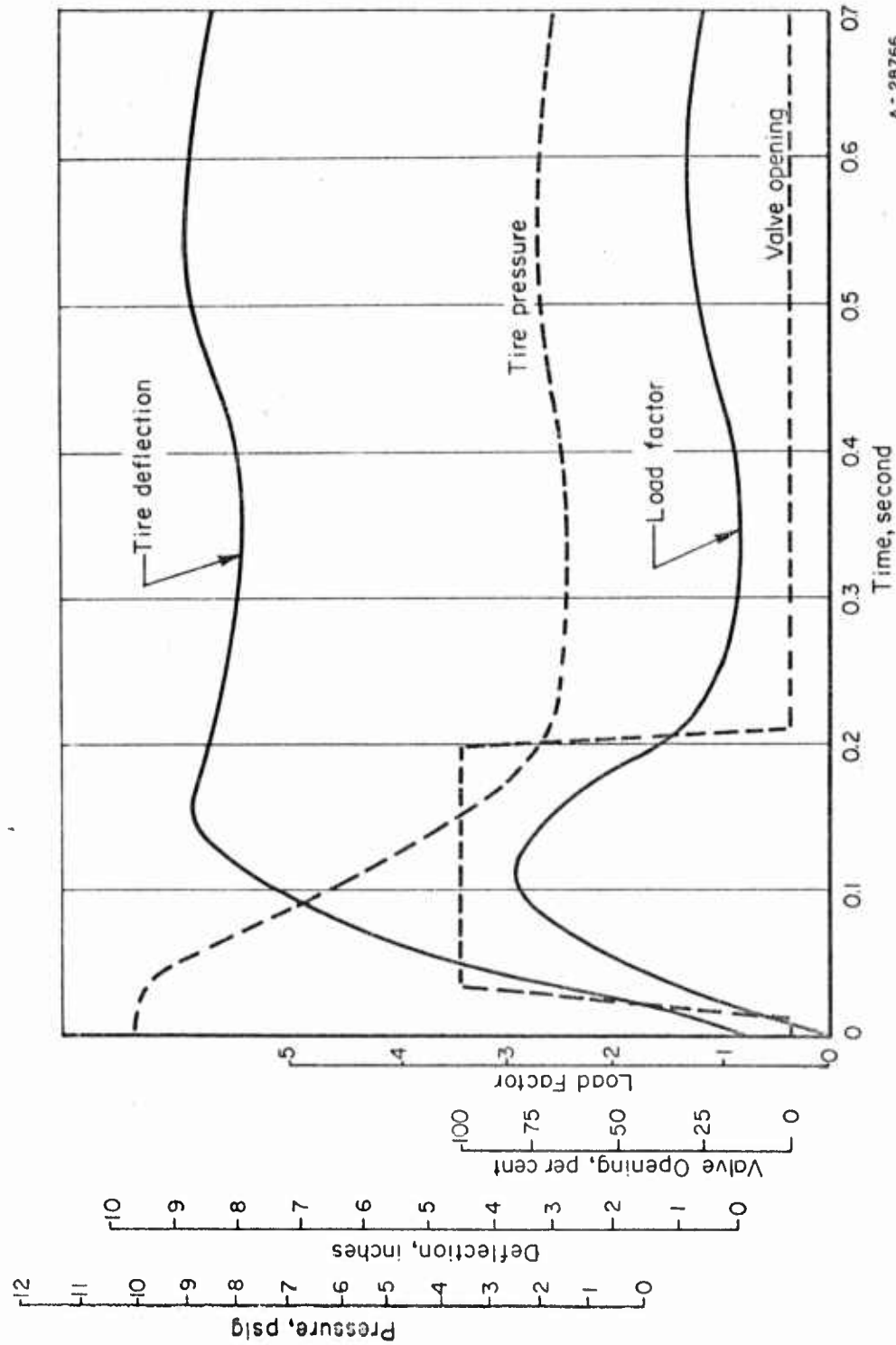


FIGURE 16. LANDING DYNAMICS OF A 34-INCH-DIAMETER HIGH-FLOTATION TIRE AT AN INITIAL TIRE PRESSURE OF 10 PSIG, A STATIC LOAD OF 990 POUNDS, AND A SINKING SPEED OF 7-3/8 FT/SEC WITHOUT VALVE ACTUATION

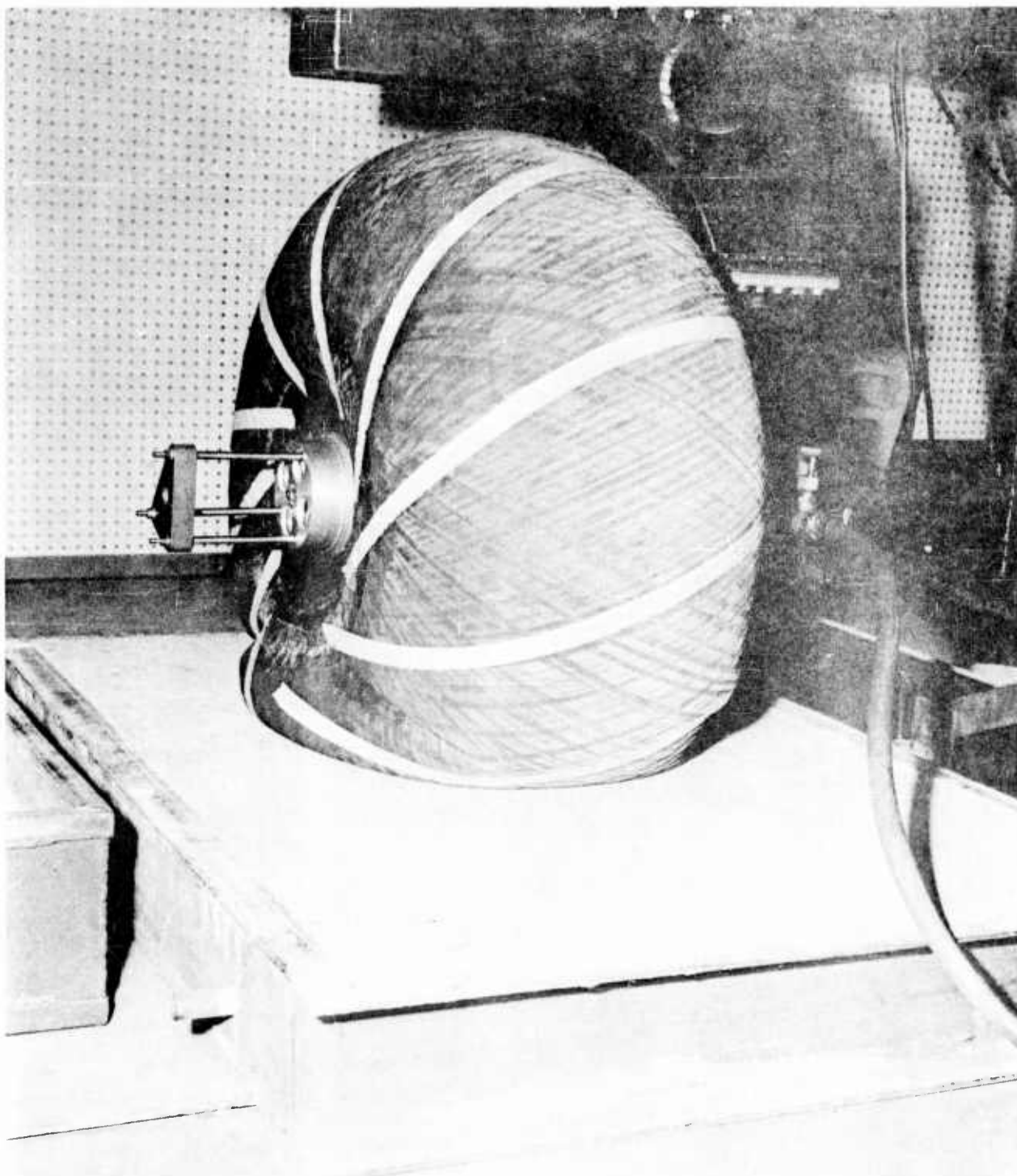
Internal axle area, 0.04 ft² (5.7 in. 2).



A-28766

FIGURE 17. LANDING DYNAMICS OF A 34-INCH-DIAMETER HIGH-FLotation TIRE AT AN INITIAL TIRE PRESSURE OF 10 PSIG, A STATIC LOAD OF 990 POUNDS, AND A SINKING SPEED OF 7-3/8 FT/SEC WITH VALVE (A) ACTUATION

Internal axle area, 0.04 ft² (5.7 in.²).



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FIGURE 18. THIRTY-FOUR-INCH HIGH-FLOTATION TIRE INFLATED TO 2 PSIG AND SUPPORTING LOAD OF 750 POUNDS, SHOWING CREASING OF SIDEWALL OF TIRE AT EXTREMELY LOW PRESSURES

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Final Tire Pressure

The final tire pressure achieved during the testing program ranged from 2 to 3 psig. It was evident, however, that the present 34-inch-diameter high-flotation tire would probably have difficulty in operating at the design final tire pressure of 2 psig when it is carrying a static load of 750 pounds. Under these conditions the tire is significantly creased near the region in contact with the ground. Figure 18 is a picture of the 34-inch-diameter high-flotation tire with a static load of 750 pounds and a pressure of 2 psig. The clearly observable folds in the tire would undoubtedly cause excessive heating of the tire during ground operation. To avoid these tire creases it is necessary to inflate the tire to around 3-1/4 psig. If the 34-inch-diameter high-flotation tire is to operate successfully with a static load of 750 pounds, it may be necessary to either limit the final tire pressure to 3-1/4 psig or to reinflate the tire to this pressure immediately after touchdown.

CONCLUSIONS

The conclusions that can be drawn from the test results are:

- (1) A deflection between the tire hub and the strut can be used for direct, mechanical valve actuation.
- (2) It is possible to fold the 34-inch-diameter high-flotation tire into a helical bellows by mounting stiffening ribs on it and drawing a vacuum of 12 inches of water in it.
- (3) The high-flotation landing-gear system is capable of successfully dissipating the landing impact energy of aircraft under laboratory drop-test conditions.
- (4) The present 34-inch-diameter tire unit functions with load factors less than four at sinking speeds as high as 8-1/4 ft/sec with an initial tire pressure of 8 psig, a static load of 780 pounds, and Valve A. This maximum sinking speed could be increased slightly by increasing the axle area available for air flow.

FUTURE WORK

In the immediate future it is planned to carry out more extensive testing of the present 750-pound unit. These tests shall be conducted with the dashpot operating in the system to determine its effect on the high-flotation tire's characteristics. Tests will also be conducted at static loads lighter than 780 pounds.

On April 11, 1958, Battelle recommended to Fairchild an expansion of the present research program. This expanded program specifies that Battelle shall design, supervise construction, and perform laboratory tests on a pair of high-flotation landing gears designed to carry a static load of 1500 pounds. These units shall be used for flight testing of the high-flotation tire system on an L-19 aircraft. The laboratory testing of both the 750-pound laboratory model unit and the pair of 1500-pound flight test units shall include drop testing with spinup before drop to an equivalent of 75 knots. The design of the flight test 1500-pound pair of gears shall include the necessary struts for suitable attachment to an L-19 type aircraft. An inflation-deflation system shall be designed including all valves, controls, and mechanisms necessary for air-borne inflation-deflation and tire folding. The expanded program also calls for the design of the necessary brackets to mount the 1500-pound gears on the N.A.C.A. drop tester at Langley Field, Virginia, and a mechanism to extend the flight test system into the slip stream from the lowered ramp of a C-123 type aircraft while in flight to evaluate tire folding in a high-velocity air stream.

The design of the 1500-pound landing-gear system is now in progress. A number of weight-saving innovations have been devised and are being incorporated into the design. A wing-lift device for the Battelle drop tester shall also be designed in addition to the various apparatus called for in the expanded research program.

A record of all technical work performed on this project appears in Laboratory Record Books 13510, 13511, and 14103.

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FAIRCHILD AIRCRAFT AND MISSILES DIVISION

H A G E R S T O W N 10, M A R Y L A N D

SUBJECT DESIGN AND DEVELOPMENT OF LABORATORY AND FLIGHT-TEST

MODELS OF LANDING GEAR FOR AIRCRAFT TO BE OPERATED FROM ROUGH

UNPREPARED FIELDS



Battelle Memorial Institute

PREPARED BY Columbus, Ohio.

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FINAL REPORT

on

THE DESIGN AND DEVELOPMENT OF LABORATORY AND FLIGHT-TEST
MODELS OF LANDING GEAR FOR AIRCRAFT TO BE OPERATED
FROM ROUGH UNPREPARED FIELDS

to

FAIRCHILD AIRCRAFT AND MISSILES DIVISION
FAIRCHILD ENGINE AND AIRPLANE CORPORATION

August 15, 1959

by

W. F. Prien, R. D. Fannon, J. H. Beck, C. W. Rodman, J. A. Hoess,
J. E. Voorhees, and R. J. McCrory

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THE DESIGN AND DEVELOPMENT OF LABORATORY AND FLIGHT-
TEST MODELS OF LANDING GEAR FOR AIRCRAFT TO BE
OPERATED FROM ROUGH UNPREPARED FIELDS

by

W. F. Prien, R. D. Fannon, J. H. Beck, C. W. Rodman,
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During the first phase of this research program, which was entitled "The Design and Development of Laboratory Models to Study the Feasibility of High-Flotation Tires for Aircraft", the high-flotation landing gear designed to carry a static load of 750 pounds was successfully tested in the laboratory, demonstrating the feasibility of the high-flotation landing-gear system under laboratory conditions. The results obtained during the testing of the 750-pound landing-gear unit encouraged Battelle to recommend to the Fairchild Aircraft and Missiles Division an expansion of the research program to include the design and development of a high-flotation landing-gear system for flight testing. In response to a request by Fairchild, Battelle submitted a proposed expanded research program dated April 11, 1958. An agreement dated June 25, 1958, was concluded between Battelle and Fairchild authorizing this program and changing the title to "The Design and Development of Laboratory and Flight-Test Models of Landing Gear for Aircraft to be Operated From Rough Unprepared Fields".

The objectives of the program were expanded to include the following items:

- (1) The design, supervision of construction, and laboratory testing of a pair of high-flotation landing gears designed to carry a static load of 1500 pounds. These units shall be used for flight testing of the high-flotation tire system on an L-19 aircraft.
- (2) The laboratory testing of both the 750-pound laboratory-model unit and the pair of 1500-pound flight-test units. This testing shall include drop test with tire spin-up before touchdown to an equivalent of 75 knots.
- (3) The design of the necessary struts for suitable attachment of the 1500-pound landing-gear units to an L-19 aircraft.
- (4) The design of an airborne inflation-deflation system.
- (5) The design of the necessary brackets to mount the 1500-pound gears on the N.A.S.A. drop tester at Langley Field, Virginia.
- (6) The design of a dynamic tire-folding test apparatus to be mounted in a C-123 aircraft to evaluate tire folding in a high-velocity air stream.

The research program was further expanded by an agreement between Battelle and Fairchild on March 18, 1959. This expanded research program provided additional funds and time to complete all of the objectives called for in the June 25, 1958, agreement plus a number of additional objectives. These additional objectives included the following items:

- (1) The construction and laboratory testing of the dynamic tire-folding test apparatus.
- (2) The installation of a safety device in the high-flotation landing gear to operate a warning light in the cockpit when the gear is ready to land.
- (3) The disassembly, inspection, modification, weather protection, and retesting after reassembly of the 1500-pound landing-gear units.
- (4) The preparation of two new tires for mounting on the high-flotation landing gear.
- (5) The provision of technical assistance to Fairchild during the flight testing of the high-flotation landing gear and the dynamic folding tests of the high-flotation tire.

During the laboratory testing of the 750- and 1500-pound landing-gear units, drop tests were conducted with wing lift as well as with tire spin-up. Both size units operated successfully under laboratory conditions, and the pair of 1500-pound units has been sent to Fairchild for flight testing.

This final report covers the work on the project from June 1, 1958, to its completion on August 15, 1959. It includes the testing of the 750-pound unit with tire spin-up and wing lift, the design of the 1500-pound unit and of its associated apparatus, and the laboratory testing of the 1500-pound unit.

SUMMARY

As a result of the successful operation obtained with the laboratory-model high-flotation landing gear designed to carry a static load of 750 pounds, the 1500-pound landing-gear unit has been designed to be adaptable to aircraft installation for flight testing. Its design embodies the same concepts and objectives as the design of the 750-pound unit, but a number of weight-saving innovations have been devised and are incorporated into its design.

Tire bleed-valve actuation in both designs is accomplished by a deflection between the tire hub and the strut when a vertical load is applied to the high-flotation tire. The heavy-load sensor that was used in the 750-pound landing-gear unit has been replaced by a much lighter closed hydraulic cylinder mounted in the axle. This cylinder has two pistons entering it; the pistons are at right angles to one another. The first of these pistons is fastened to a vertical load-carrying link and is larger in area than the second piston which is used to actuate the tire bleed valve. A high vertical load and a small deflection imposed on the first piston results in a lower axial load and larger deflection of the second piston.

Except for changes in geometry, the design of the pressure sensor and tire bleed valve for the 1500-pound landing-gear unit has remained essentially unchanged from that of the 750-pound unit. One additional feature, however, has been added to the

pressure sensor. A microswitch, which would be connected to a warning light in the plane, has been installed on the pressure sensor and is actuated when the pressure sensor cocks. This warning light would inform the pilot whether the pressure sensor was cocked.

The helical-bellows method of tire folding is used to fold the 43-inch-diameter tire. The same tire modifications used to induce the 34-inch-diameter tire to fold into a helical bellows are used on the 43-inch-diameter tire. A tire-folding apparatus, which is to be mounted in a C-123 aircraft and which will extend a 43-inch-diameter tire into the slip stream while in flight to test tire folding under dynamic conditions, has been designed, constructed, and successfully operated in the laboratory.

Struts to mount the 1500-pound landing-gear units on an L-19 aircraft, an inflation system to control the tire pressure of these units during flight testing, and a linkage to mount the high-flotation landing gear on the N.A.S.A. drop-test facility at Langley Field, Virginia, have been designed. The Battelle drop-test facility has been strengthened for drop tests with tire spin-up, and tire spin-up and wing lift devices have been designed and constructed.

Drop tests have been conducted with the 750- and 1500-pound landing-gear units. During these tests the initial tire pressure, static load, sinking speed, valve configuration, tire spin-up speed, and percentage wing lift were varied to determine their effect on the operation of the system. The results of these tests were highly satisfactory. The 43-inch-diameter high-flotation tire was successfully tested at sinking speeds ranging from 2-1/2 to 10-1/2 ft/sec.

DESIGN OF THE HIGH-FLOTATION LANDING GEAR AND ITS ASSOCIATED APPARATUS

Design of Components of the 1500-Pound Landing-Gear Unit

The basic method of operation of the 1500-pound high-flotation landing gear is patterned after its successfully performing 750-pound predecessor. While there are no basic changes in the method of operation of the 1500-pound unit from that of the 750-pound unit, there are a number of significant weight-saving design changes in some of the components. Weight considerations were necessitated by the fact that the 1500-pound unit was to be mounted and flight tested on an L-19 aircraft after preliminary laboratory testing had established the effect of the many variable parameters on the operation of the unit. The results of these changes in component design can be seen in the reduction of weight from the 73 pounds of the 750-pound unit to the 50 pounds of the 1500-pound unit and in the simplification of the mounting linkage which makes the unit more applicable to mounting and testing on an aircraft.

Landing-Gear Linkage

Tire bleed-valve actuation in the 1500-pound unit, as in the 750-pound unit, is accomplished by means of a relative displacement between the axle and the strut. While

the linkage used to mount the 750-pound unit prevented braking loads from drastically affecting the vertical load carried by the vertical load sensor, it was decided that too heavy a penalty in both weight and complexity had to be paid for this feature. Therefore, the mounting linkage for the 1500-pound unit was considerably simplified and consists of a four-bar linkage. The only limitation imposed on the operation of the system by this simplification is that the brakes should not now be applied during the first instant after tire touchdown since braking will affect the axial load carried by the vertical load-carrying link.

Figure 1 is a schematic sketch of the mounting linkage of the 1500-pound unit. The axle is L-shaped and is mounted to the strut by means of a pin which is parallel to, but which is located off center from, the axle and tire center line. This arrangement permits the axle and tire center line to be pivoted about this mounting pin. A vertical load-carrying link has one of its ends pinned to the strut and the other pinned to a slider link, or piston, that is mounted in a hydraulic cylinder fixed to the axle. The deflection between the slider link, or piston, and the axle actuates the tire bleed valve.

Wheel, Axle, and Brake

The tire is mounted on a 7075-T6 aluminum cylinder which serves as a wheel for the 43-inch-diameter tire. The earlier analytical study conducted at Battelle specified a required air-bleed orifice area of 14.2 square inches for the 43-inch-diameter, 1500-pound static load, high-flotation tire. In the 1500-pound unit the air is bled from the tire through eight large ports, which have a total area of 21.5 square inches, in the outboard end of the wheel. The wheel has an internal diameter of 4.75 inches, which provides approximately 17.7 square inches of flow area.

The wheel is mounted on a nonrotating axle, which is made of SAE 4340 steel hardened to 35 RC, by means of two Timken Roller Bearings. The outboard bearing is approximately located on the center line of the tire, and the center-to-center bearing distance is 10.75 inches. The L-shaped axle is essentially two cylinders intersecting at right angles. The wheel and tire are mounted on the longer leg of the axle, and the pivot pin, which fastens the axle to the strut, passes through the shorter leg. The distance between the wheel and tire center line and the pivot-pin center line is 3.75 inches.

Figure 2 is a photograph of the inboard side of the right-hand 1500-pound unit as mounted on the Battelle drop tester. The axle mounting and brake components are clearly visible in this picture. A spot brake with two cylinders or spots and with a single rotating disk is used on the 1500-pound unit. The brake disk is driven on its external periphery by a toothed flange which is fastened to the rotating wheel, and the brake-cylinder housing is fastened to the nonrotating axle. Because of the increase in the rolling radius of the 43-inch-diameter high-flotation tire over that of the conventional L-19 tire, it is necessary approximately to double the braking torque available from the conventional L-19 brake system. This is accomplished by using two 2-inch-diameter brake cylinders in place of the conventional one 2-inch-diameter brake cylinder that is used on the L-19. These cylinders are located 3-1/2 inches from the axle center line, and for a cylinder pressure of 900 psig and a brake-lining coefficient of friction of 0.25 the torque developed is 10,000 inch-pounds. Two smaller brake cylinders are used in place of one larger cylinder because they permit the use of a smaller diameter brake disk and, thus, do not reduce the ground clearance as much as a single larger cylinder would.

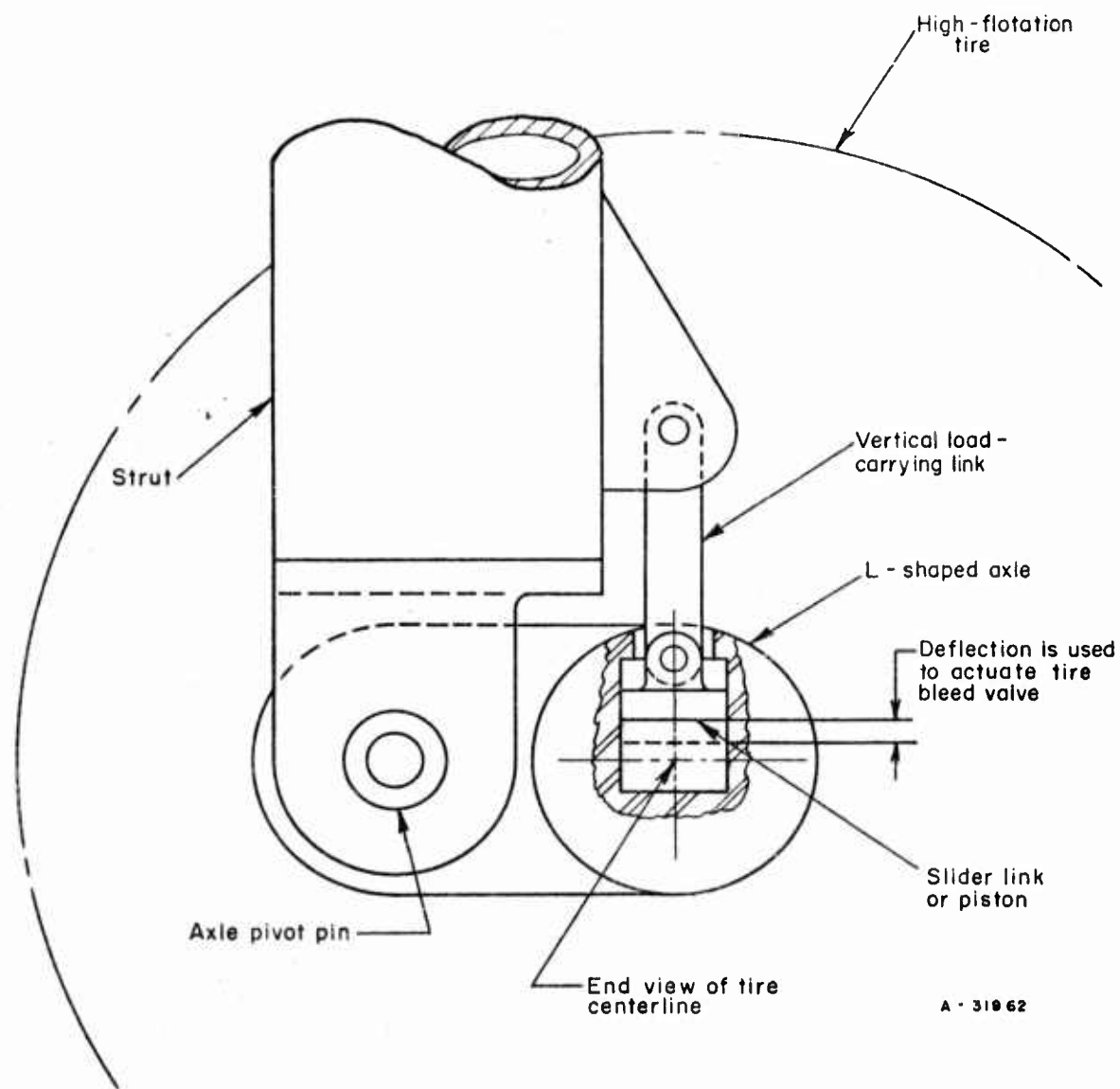


FIGURE 1. SCHEMATIC DRAWING OF THE MOUNTING LINKAGE OF THE 1500-POUND LANDING-GEAR UNIT

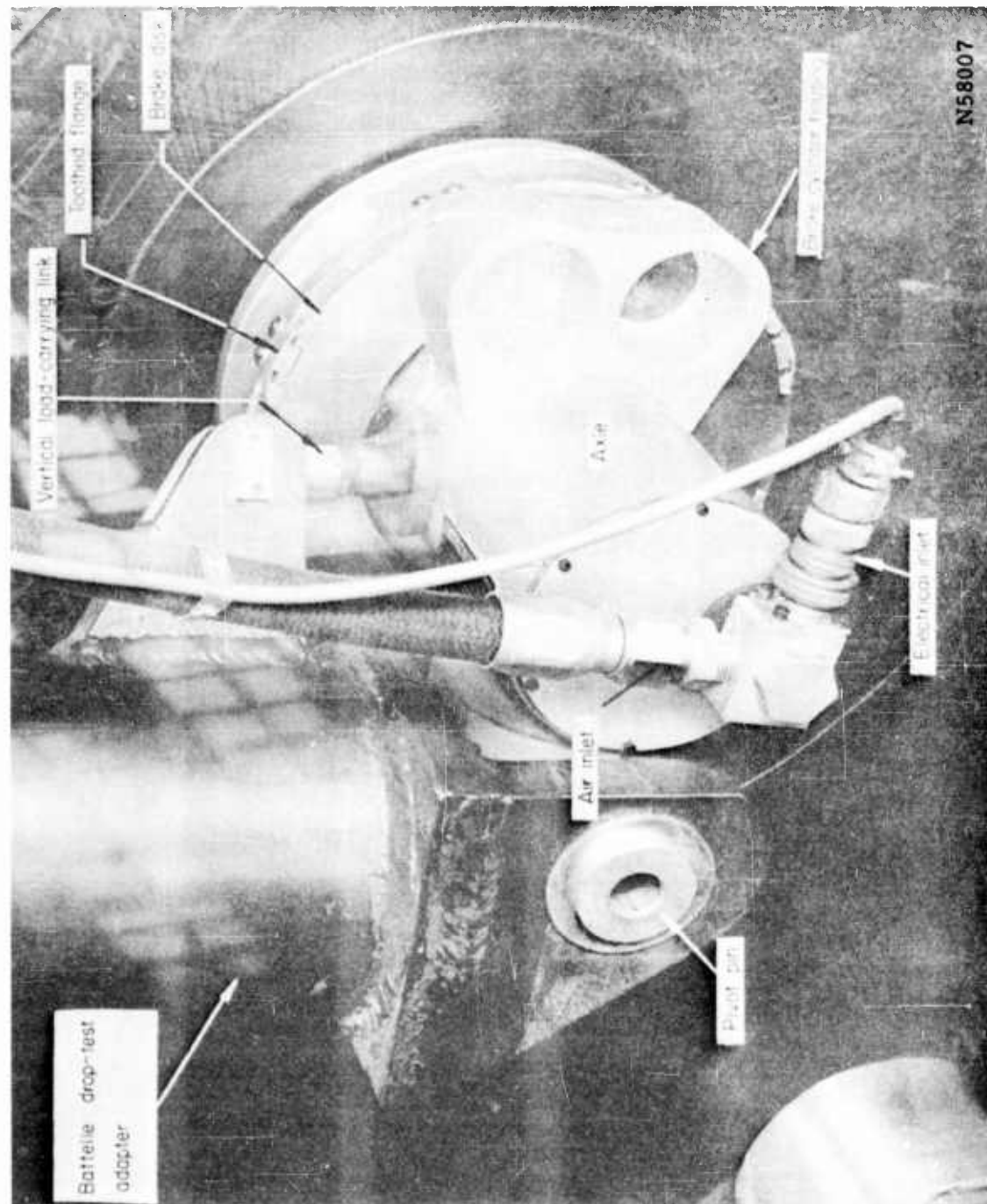


FIGURE 2. BRAKE AND MOUNTING ARRANGEMENT OF THE 1500-POUND HIGH-FLOATATION LANDING GEAR

Load-Sensing Cylinder

To reduce the weight and complexity of the load sensor used in the 750-pound unit, the energy-absorbing dashpot was not included in the design of the 1500-pound unit, and a method was devised to eliminate the large load-sensing spring that was formerly required. This method uses a small closed hydraulic cylinder which is mounted in the axle, and which has two pistons located at right angles to one another, entering it. Figure 3 is a schematic sketch of this load-sensing cylinder. One of the two pistons entering the load-sensing cylinder is larger in area than the other. The larger piston, which is mounted in the vertical direction and which is fastened to the ball-ended vertical load-carrying link, is 1-1/2 inches in diameter and has an area of 1.77 square inches. The smaller piston actuates the tire bleed valve and is formed by a stepped shaft which passes through the cylinder along the center line of the axle. This stepped shaft has diameters of 13/16 and 3/8 of an inch and has a differential area of 0.41 square inch. Therefore, the areas of the pistons are in the ratio of approximately 4.33 to 1, and the spring rates of the comparatively small valve and push-rod springs are increased 4.33 times relative to the larger piston.

When a vertical load of 4800 pounds is imposed on the larger piston by the vertical load-carrying link, the internal cylinder pressure rises to 2710 psig. The push-rod spring pulls the larger diameter portion of the stepped shaft back into the cylinder when the load on the larger piston is relieved. This spring has a preload of 15 pounds and a spring rate of 159 pounds per inch. Since the unit is located on the center line of the axle and since the pistons are located at right angles to one another, the bell-crank mechanism used to actuate the valve in the 750-pound unit has also been eliminated.

The load-sensing function is performed in the following manner:

- (1) The vertical load on the tire is imposed on the vertical load-carrying link which applies this load to the larger piston in the load-sensing cylinder.
- (2) A preload is applied to the stepped shaft, which passes through the load-sensing cylinder, by the valve and push-rod springs.
- (3) As the load on the larger piston increases, the fluid pressure in the load-sensing cylinder increases.
- (4) When the pressure in the cylinder reaches a value that applies a force on the stepped shaft sufficient to overcome the preload in the valve and push-rod springs, the stepped shaft is actuated and begins to open the tire bleed valve.
- (5) The displacement of the stepped shaft is then directly proportional to the increase in load on the larger piston.
- (6) The travel of the stepped shaft is limited to 1 inch by a rubber stop, and any further increase in the load on the larger piston increases the pressure in the load-sensing cylinder, but does not result in any further displacement of the stepped shaft.

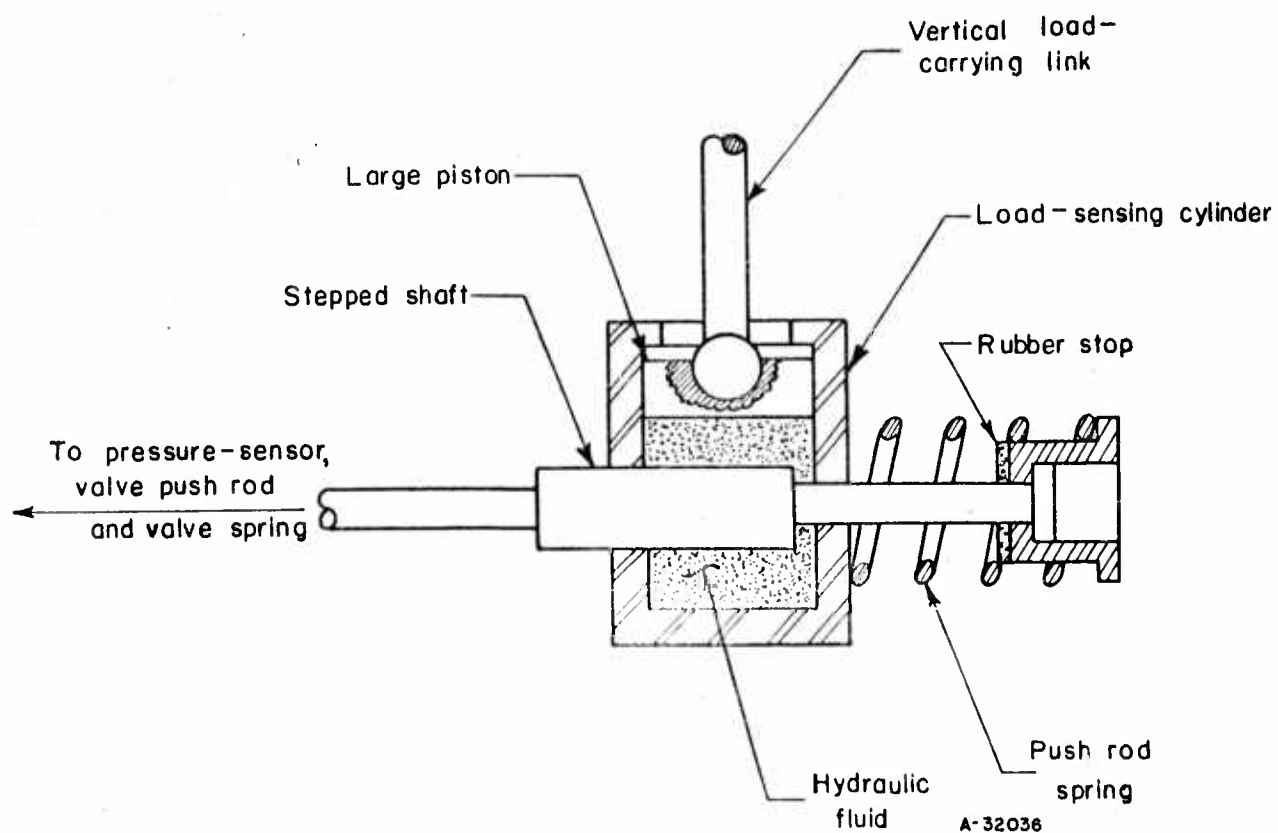


FIGURE 3. SCHEMATIC DRAWING OF LOAD-SENSING CYLINDER

Pressure Sensor

Because of the satisfactory operation of the pressure sensor in the 750-pound unit, the method of operation of the pressure sensor used in the 1500-pound unit is identical with that used in the 750-pound unit. The only major design changes were concerned with the geometry of the component. One additional feature, however, was added to the pressure sensor. Since the unit is to be flight tested, it was considered essential to provide some means of informing the pilot whether or not the pressure sensor is cocked before landing. To accomplish this, a microswitch is mounted on the pressure-sensor frame and is actuated when the pressure-sensor guide block is in the cocked position. The actuation of this switch turns on a light in the cockpit of the plane and lets the pilot know whether the pressure sensor is cocked. The electrical leads to this switch are brought out of the 1500-pound unit through the air passage. The pressure sensor, as installed on the L-19 aircraft, is set to disengage at a pressure of 2-1/2 psig and to engage or cock at a pressure of approximately 7-1/2 psig. Figure 4 is a photograph of the vertical load-carrying link, load-sensing cylinder, pressure sensor, and the air- and electrical-inlet assembly.

Tire Bleed Valve

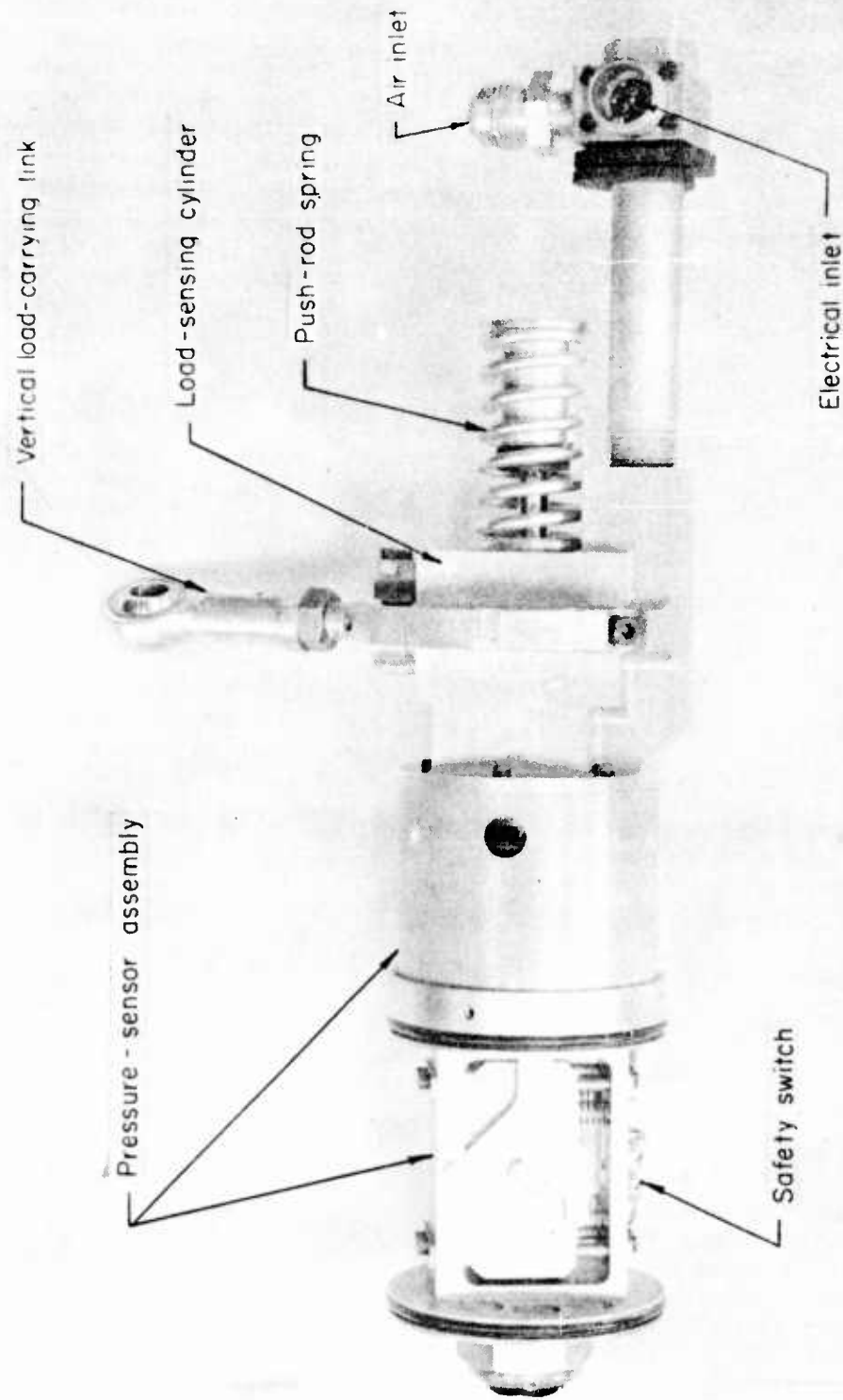
The design of the tire bleed valve for the 1500-pound unit remained essentially the same as that for the 750-pound unit except for changes in geometry. The available valve stroke from the full open to the full closed position in the 1500-pound unit is 1 inch. The programmed valve-port cylinder has eight ports, an internal diameter of 8-3/4 inches, and a maximum available area of 24.4 square inches. To reduce the O-ring friction on the outboard sleeve, the large reciprocating O-ring seal has a hardness of 40 durometer. The valve spring is preloaded to 95 pounds and has a spring rate of 43 pounds per inch. This preload is sufficient to hold the outboard sleeve tightly against the O-ring face seal, and no leakage of either the O-ring reciprocating or face seal was noted at tire pressures as high as 25 psig. A vertical load of approximately 1050 pounds is required to start valve actuation, and the valve is full open at a vertical load of approximately 1950 pounds. As the tire bleed valve and the valve rod rotate with the tire and as the pressure sensor and valve push rod, which are mounted in the axle, do not rotate, a rotary thrust bearing is located between the valve rod and the valve push rod.

Folding of the 43-Inch-Diameter High-Flotation Tire

The 43-inch-diameter high-flotation tire is folded into a helical bellows in the same manner as the 34-inch-diameter tire. The same tire-folding provisions are necessary for both tires, and the same method of locking the inboard tire flange to the axle is employed in both units. These tire-folding provisions and the reasons for each and the design of the tire-flange locking mechanism are explained in detail in the Phase Report on this project, dated August 1, 1958.

Tire Modifications

To determine the most satisfactory stiffening-rib configuration for inducing the 43-inch-diameter high-flotation tire to fold into a helical bellows, tests were conducted



N58010

FIGURE 4. VERTICAL LOAD-CARRYING LINK, LOAD-SENSING CYLINDER, PRESSURE-SENSOR, AND AIR AND ELECTRICAL INLET ASSEMBLY

with various combinations of the number of ribs and the rib lead angle. Type "B" V-belts were cemented to the tire as stiffening ribs and performed satisfactorily. Lead angles of 10, 25, and 45 degrees were employed; a lead angle of 10 degrees gave the best results. Eight and ten stiffening ribs were used to determine the most desirable number of tire folds. The tire creased more easily with eight than ten folds, but ten folds permitted a slightly smaller folded diameter than eight, and it was decided that ten is the best number for this tire. The smallest diameter of the circular concentric stiffening ribs on the side walls of the tire that will insure a uniform outer diameter of the folded tire package is 24 inches. It was found that a vacuum of only 8 inches of water was required to hold the tire in the completely folded position.

To insure the proper folding of the tire that was used in the above tests, it was necessary to hold the tire hubs axially in their operational position until after the tire had been creased and one hub had rotated approximately 11 degrees with respect to the other. The inboard hub was then released and allowed to move axially toward the outboard hub. However, to fold successfully tire Number 16, the tire that will be used in the dynamic tire-folding tests, it was found to be necessary to hold the hubs axially in their operational position until they have rotated approximately 30 degrees with respect to one another. This variation in the folding requirements for the two tires indicates that, for tires of different stiffness or cord angle, it will be necessary to perform folding tests to determine what tire modifications are necessary to give optimum folding performance for that particular tire construction. Figure 5 is a sequence of photographs of the 43-inch-diameter high-flotation tire taken at various stages during the folding cycle.

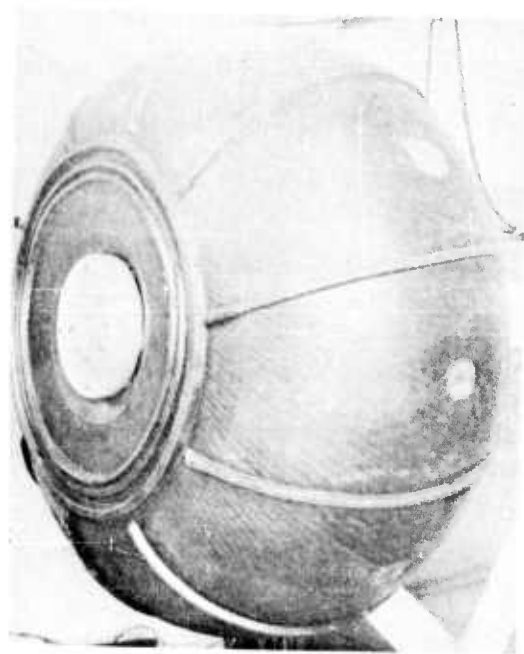
Dynamic Tire-Folding Apparatus

To test the folding of the tire under dynamic conditions such as will be encountered during operation, a tire-folding apparatus which is to be installed in a C-123 aircraft was designed, constructed, and operated in the laboratory. Figure 6 is a schematic diagram showing the manner in which the 43-inch-diameter high-flotation tire will be extended and retracted from the C-123 during the dynamic folding tests. The apparatus will be rigidly fastened to the cargo ramp of the C-123, and the tire will be extended into the slip stream by rotating the extension arm 180 degrees. The extension arm is positioned by a chain that is driven by a powered screw jack.

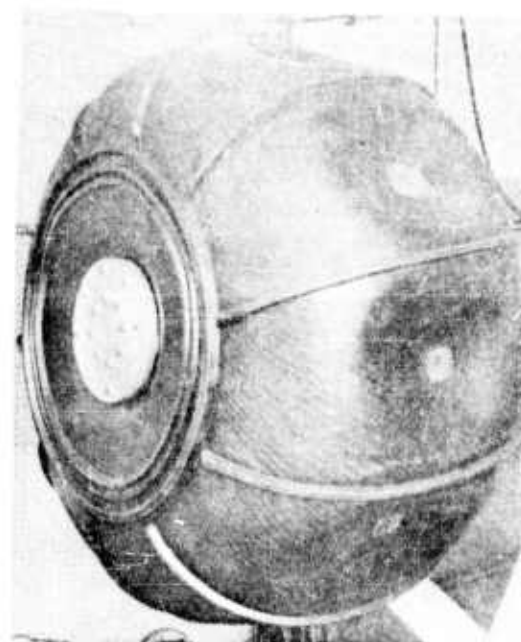
The tire is connected to a three-way solenoid valve which is actuated to either inflate or deflate the tire. When this valve is in the inflate position, the tire is open to an accumulator which has been preinflated to a pressure that is sufficient to inflate the tire quickly from the folded condition. When the valve is in the deflate position, the tire is open to the vacuum side of an industrial-type vacuum-cleaner blower, and folds as it is evacuated.

Design of the L-19 Struts and Inflation System

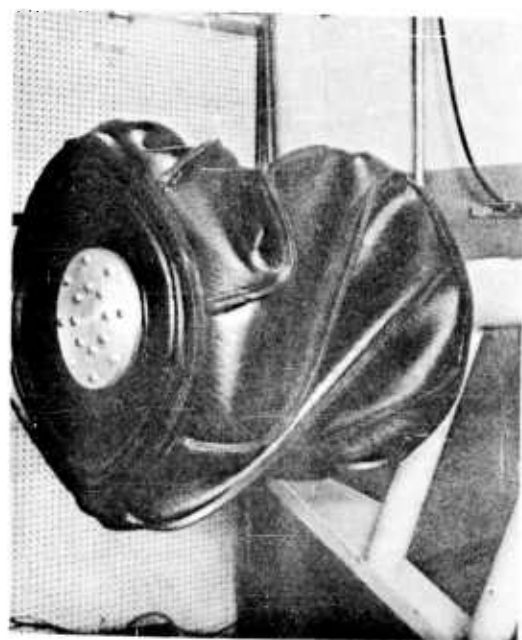
Calculations showed that the spin-up and spring-back loads that would be applied to the high-flotation tire during landing would be larger than the maximum allowable spin-up or spring-back load that can be safely carried by the front-strut attachment fittings on the L-19. To permit landings at comparatively high sinking speeds with the



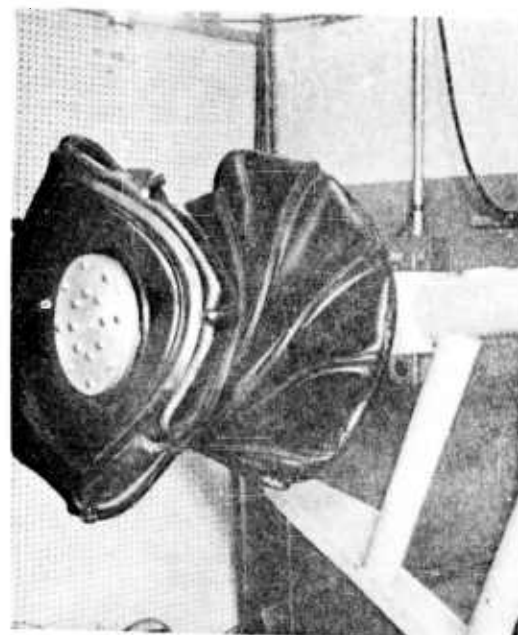
Tire Inflated N59889



Tire at Atmospheric Pressure N59890

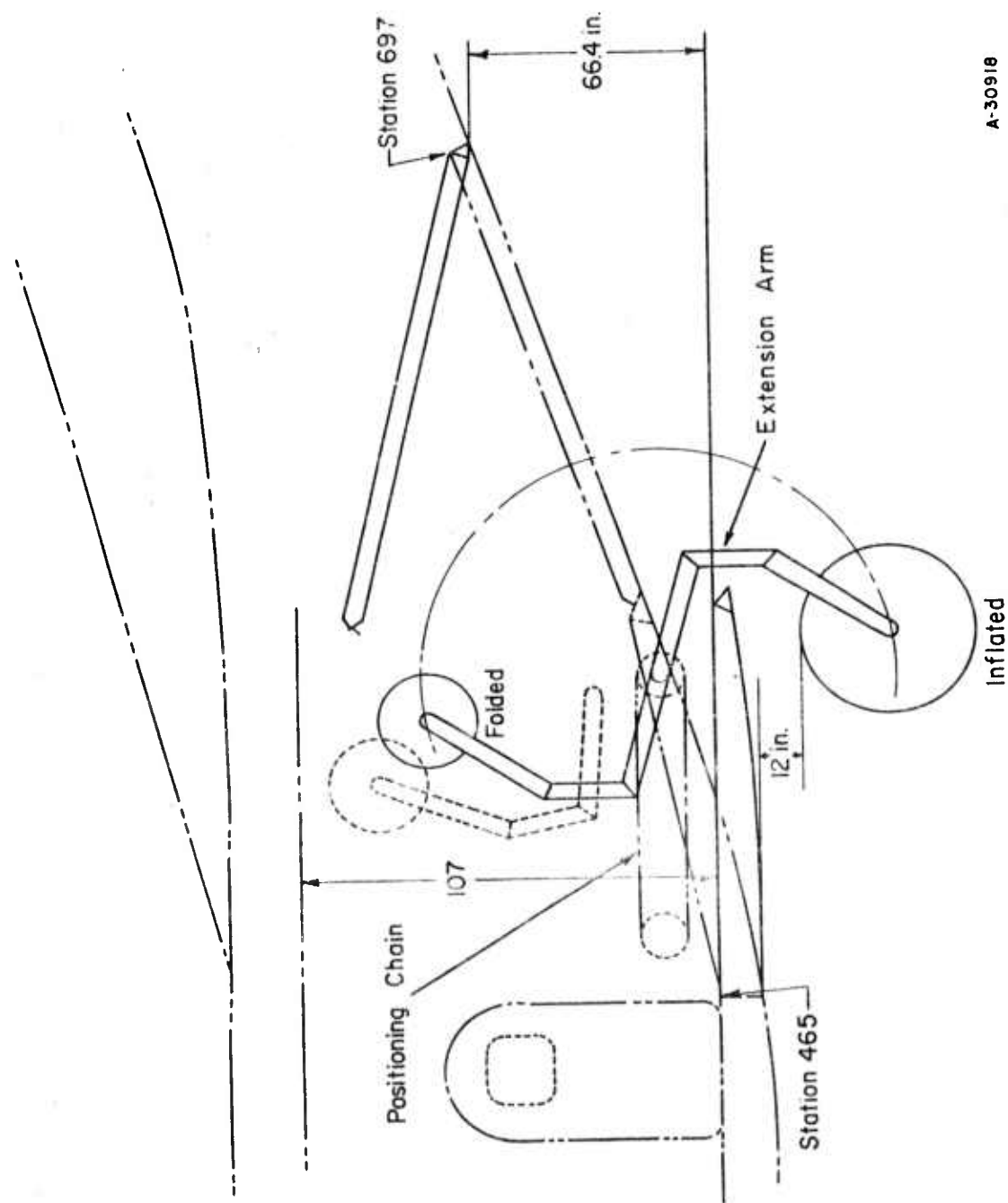


Tire During Folding Operation N59891



Tire Folded N59892

FIGURE 5. FOLDING SEQUENCE OF THE 43-INCH-DIAMETER, HIGH-FLOTATION TIRE



A-30918

FIGURE 6. SCHEMATIC DIAGRAM SHOWING 43-INCH-DIAMETER HIGH-FLotation TIRE IN EXTENDED AND RETRACTED POSITIONS FOR FOLDING TEST ON C-123

high-flotation landing gear mounted on this aircraft, it was necessary to mount the landing gear on the L-19 by means of a structure which is fastened to the rear pontoon fittings as well as to the front-strut fittings.

Both of the high-flotation landing gears are mounted on a common front-strut weldment which is fastened to the L-19 by means of adapters that are mounted in the conventional L-19 front-strut fittings. The front-strut weldment is pinned to these adapters and is free to pivot in a fore-aft direction. It is held in place by two ball-ended rear struts which are fastened to it at the points where the landing-gear units are attached and which extend rearward to the rear pontoon-attachment fittings. The major reaction forces due to tire spin-up and spring back are carried by these rear struts.

Since the tires to be mounted on the L-19 for flight testing will not be folded, an inflation system has been designed without provisions for tire deflation. This system consists of a 3000-psig air-storage accumulator that is supplied by a 2-cfm compressor. Each tire is independently inflated through its own adjustable lever-operated pressure regulator. The system has provisions for automatic quick reinflation of the tires by a predetermined amount after tire bleed down so that the tire run-out pressure can be increased to a sufficient value to reduce tire wear and heating during the flight-test program. This quick reinflation is accomplished by connecting a second accumulator to the tires immediately after both tire bleed valves have closed. This second accumulator is preinflated to an adjustable pressure that is sufficient to raise the pressure in the two tires by the desired amount.

Design of the Langley Field Drop-Test Linkage

The minimum load that can be dropped in the N.A.S.A. drop-test facility at Langley Field, Virginia, is larger than 1500 pounds. This makes it impossible to conduct drop tests with the high-flotation landing gear designed to carry a static load of 1500 pounds mounted directly to the present drop-test carriage. Therefore, a linkage similar to the four-bar linkage used for drop testing at Battelle was designed to be fastened to the drop-test carriage at Langley Field. The high-flotation landing gear would be mounted on this linkage during the drop testing. The drop-test carriage would be fixed at a given vertical position, and the vertical motion of the high-flotation landing gear would be accomplished by raising and dropping the four-bar linkage in the same manner as is done with the Battelle drop tester. The horizontal motion of the unit would be provided by the N.A.S.A. drop tester. Adapters were designed to permit the testing of the landing gear with both yaw and roll. A safety stop was designed to limit the downward travel of the four-bar linkage. This safety stop would prevent the damaging of the high-flotation landing gear in the event of a tire failure.

LANDING-GEAR DROP-TEST PROGRAM

Laboratory Drop-Test Apparatus

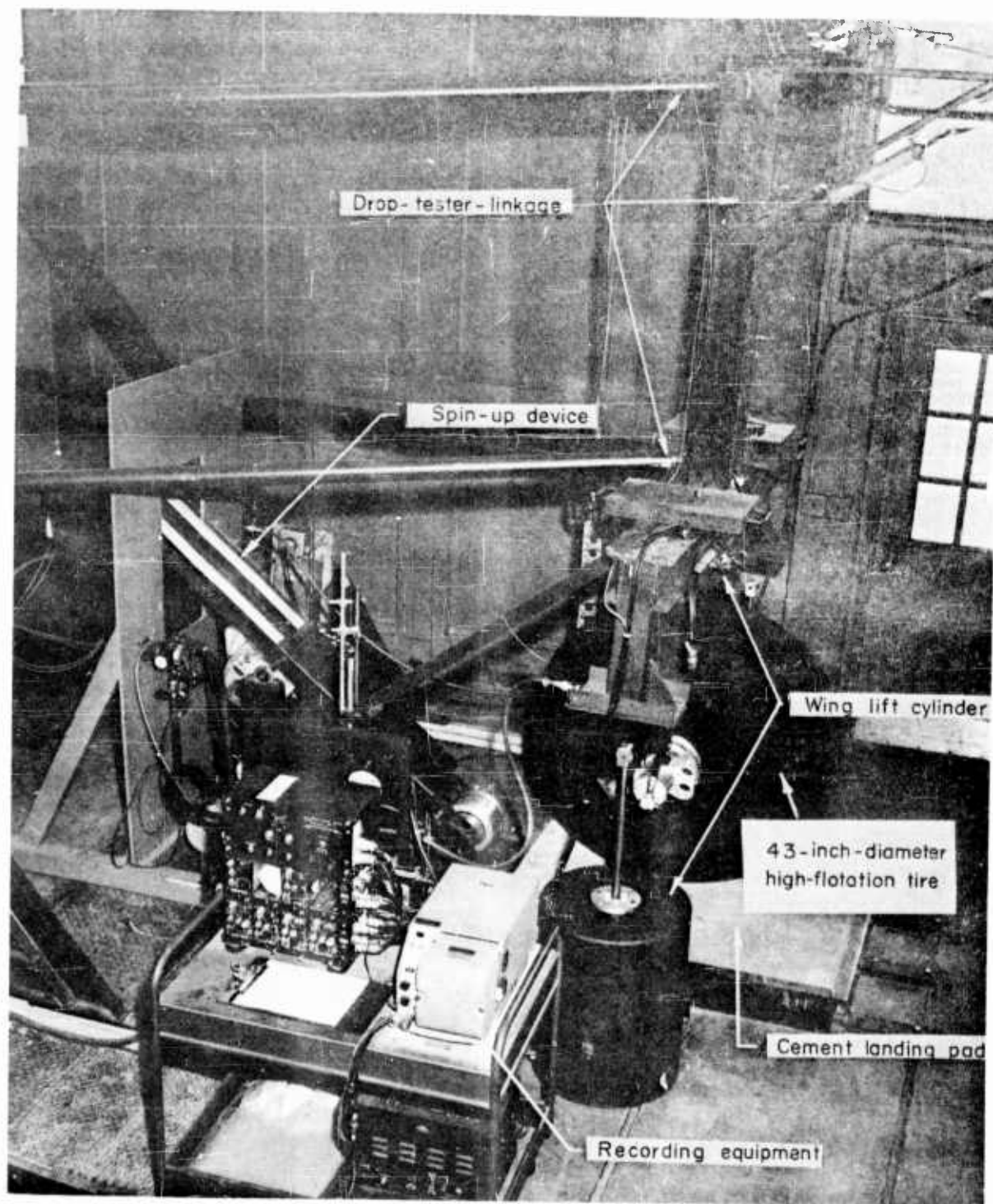
Both the 750- and 1500-pound static-load high-flotation landing gears were drop tested under laboratory conditions at Battelle to determine the necessary conditions for successful system operation and to gain some insight into the possible effect that tire spin-up and wing lift will have on the operation of the system. To conduct drop tests with tire spin-up before touchdown and with wing-lift, it was necessary to make a number of alterations to the Battelle drop tester and to construct some additional components. The existing drop tester, which was described in the Phase Report, was strengthened and more rigidly mounted to the floor to permit drop tests with tire spin-up before touchdown, and tire spin-up and wing lift devices were designed and constructed. Figure 7 is a photograph of the Battelle drop-test apparatus showing the installation of the tire spin-up and wing-lift devices.

Tire Spin-Up Device

The tire spin-up device is capable of spinning up either the 34- or 43-inch-diameter high-flotation tire at speeds up to over 75 knots. An 8-1/2-inch-diameter aluminum roller, which is belt driven by a 2-horsepower motor, spins the tire up to speed when the roller and tire are brought into contact with one another. Both the roller and motor are mounted on an arm which is pivoted on a stationary frame. The arm is approximately 6 feet long and is pivoted at its mid-point. The roller is located at one end of the arm and can, therefore, be positioned to any location on an arc having a 3-foot radius. The unit is so positioned that this arc always intersects the circumference of the tire being tested, regardless of the drop height. To pivot the arm into position, a force is applied to the end of the arm on the opposite side of the pivot from the roller. Before the tire is dropped the arm is pivoted to a clear position.

Wing-Lift Device

Two air springs, which are located on either side of the landing pad and which engage the drop-tester carriage, are used to provide wing lift on the Battelle drop tester. They each consist of a cylinder so mounted in a tank that the combination has a low ratio of cylinder displacement to total volume. The total volume of a tank is 5700 cubic inches. Each cylinder is 3-5/8 inches in diameter, and each wing-lift piston has a maximum stroke of 18 inches. This results in a maximum displacement of 186 cubic inches and a maximum pressure increase of approximately 3.5 per cent. Since the pressure increase is small, the force on the piston remains essentially constant throughout the piston stroke. The drop-tester carriage does not engage the pistons until after it is dropped a given distance to obtain the desired sinking speed. By varying the pressure in the tanks, the per cent of wing lift can be controlled.



N58001

FIGURE 7. LANDING-GEAR DROP-TEST APPARATUS AND RECORDING INSTRUMENTATION

Drop-Tester Instrumentation

In drop tests of the high-flotation landing gear conducted after the Phase Report, the following information was recorded:

- (1) Vertical tire deflection
- (2) Vertical acceleration
- (3) Valve position
- (4) Sinking speed
- (5) Rotational velocity of the tire
- (6) Horizontal spin-up force
- (7) Time base.

A Consolidated 5-116 fourteen-channel recording oscillograph was used to record the required information in place of the Consolidated 5-114 eighteen-channel unit that was used earlier in the project. The chart speed used was 32 inches per second.

Vertical tire deflection, vertical acceleration, valve position, sinking speed, and time base were obtained in the same manner as described in the Phase Report. Because valve position was measured with a transducer attached to a rotating member, a slip-ring system would have been necessary for completing the circuit between the transducer and the recorder in drop tests with tire spin-up. For this reason, valve position was recorded in zero spin-up speed tests only. The rotational velocity of the tire was obtained in two manners. In drop tests with the 750-pound unit, the rotational velocity of the tire was monitored by a tach-generator. The armature of the tach-generator was coupled to and driven by the rotating axle, and the case was mounted on the stationary-axle housing. In drop tests with the 1500-pound unit, as no means was readily available to mount the tach-generator between the rotating and nonrotating components of the unit, the tire rotational speed was monitored with a magnetic pickup. This magnetic pickup was mounted on the stationary brake housing and so located that the teeth on the rotating flange that drives the brake disk interrupted the magnetic field and induced a signal in the pickup coil. By recording these interruptions with respect to time, the average rotational speed of the tire over a given time interval was determined. Horizontal spin-up force was obtained in drop tests with both the 750- and 1500-pound units by cementing strain gages on the adapters used to mount these units to the Battelle drop tester.

Drop-Test Conditions

Since the publication of the Phase Report, extensive drop testing of both the 750- and the 1500-pound landing-gear units has been carried out on the Battelle drop-test facility. Drop tests with the 750-pound unit were conducted to determine what effects lower static load, tire spin-up before touchdown, wing lift, and dash-pot operation have on the performance of the unit. During drop testing of the 1500-pound unit, the static

load, initial tire pressure, sinking speed, valve area, tire spin-up speed, and percentage wing lift were varied to determine their effect on the landing operation and to establish an envelope of variable conditions in which successful landings could be made.

750-Pound Unit

All of the tests with the 750-pound unit were conducted with a total valve area of 10.8 square inches. Static loads of 710, 788, and 988 pounds were used, and the initial tire pressure ranged from 7 to 11 psig. The sinking speed was varied from 2-1/2 to 8-1/4 ft/sec in the 710- and 788-pound static-load tests and from 2-1/2 to 7-3/8 ft/sec in the 988-pound static load tests. Tire spin-up speeds before touchdown of 0, 32, 63, and 80 knots were used, and drop tests were conducted with 0, 50, and 100 per cent wing lift. Drop tests with the dash pot installed were conducted only with zero tire spin-up speed and zero per cent wing lift.

1500-Pound Unit

During the drop testing of the 1500-pound landing-gear unit, drop tests were carried out with static loads of 920, 1200, and 1500 pounds. Sinking speeds ranging from 2-1/2 to 10-1/2 ft/sec were used. Initial tire pressure was varied from 21 to 8 psig, and three different valve configurations were used. Valves A and B are similar in that they both have directly proportional valve-area versus valve-stroke characteristics. Valve A, however, has a larger magnitude of total area than Valve B. Valve C is so programmed that the rate of valve-area opening is low during the first part, but high during the last part of the valve stroke. A description of the three valves follows:

- (A) The area of Valve A increases at the rate of $24.4 \text{ in.}^2/\text{in.}$ valve stroke and for a 1-in. valve stroke has a total area of 24.4 in.^2 .
- (B) The area of Valve B increases at the rate of $14.6 \text{ in.}^2/\text{in.}$ valve stroke and for a 1-in. valve stroke has a total area of 14.6 in.^2 .
- (C) The area of Valve C increases at the rate of $9.2 \text{ in.}^2/\text{in.}$ valve stroke for the first 3/8-in. valve stroke and $24.4 \text{ in.}^2/\text{in.}$ valve stroke for the last 5/8 in. of valve stroke. The total area for a 1-in. stroke is 18.7 in.^2 .

Tire spin-up speeds before touchdown of 0, 61, and 78 knots were used, and percentage wing lift was varied from zero to 100 per cent.

750-Pound-Unit Drop-Test Results

710-Pound Static Load

As indicated by the increase in the maximum vertical-load factor when the static load was reduced from 990 to 780 pounds in earlier tests, the maximum vertical-load factor obtained in the drop tests with a static load of 710 pounds was higher for a given sinking speed than that obtained in drop tests conducted with a static load of 780 pounds.

Vertical-load factor is defined as the ratio of instantaneous vertical load to total static weight. An initial tire pressure of 8 psig resulted in the best over-all performance of the unit with a static load of 710 pounds. Table 1 is a listing of the maximum vertical-load factors obtained in drop tests without tire spin-up and wing lift over the full range of static loads and sinking speeds used during the drop testing of the 750-pound unit. The maximum vertical-load factor varied from 1.5 in the test with a static load of 990 pounds, an initial tire pressure of 11 psig and a sinking speed of 2-1/2 ft/sec to 4.2 in the test with a static load of 710 pounds, an initial tire pressure of 8 psig, and a sinking speed of 8-1/4 ft/sec.

TABLE 1. MAXIMUM VERTICAL-LOAD FACTORS OBTAINED IN DROP TESTS WITH THE 750-POUND LANDING GEAR

| Aircraft Sinking
Speed, ft/sec | Maximum Vertical-Load Factor(a) | | |
|-----------------------------------|---------------------------------|-------------|-------------|
| | 990 Pounds† | 780 Pounds* | 710 Pounds* |
| 2-1/2 | 1.5 | 1.8 | 1.8 |
| 4-3/4 | 2.2 | 2.4 | 2.5 |
| 6-1/4 | 2.5 | 2.8 | 3.1 |
| 7-3/8 | 3.0 | 3.3 | 3.6 |
| 8-1/4 | -- | 3.8 | 4.2 |

Note: Constant axle area of 5.7 in.²; total valve area of 10.8 in.²; and zero spin-up speed, zero per cent wing lift.

(a) + - Initial tire pressure of 11 psig for 2-1/2 and 4-3/4 ft/sec sinking-speed tests and of 10 psig for 6-1/4 and 7-3/8 ft/sec sinking-speed tests.

* - Initial tire pressure of 8 psig for all sinking-speed tests.

Dash Pot Installed in Series With the High-Flotation Landing Gear

In the drop tests that were conducted with the dash pot installed in series with the high-flotation landing gear, a high shock load was imposed on the unit by the bottoming of the piston in the dash-pot cylinder. After the first series of drop tests with the dash pot installed, this shock load damaged the miniature ball bearings on the ends of the valve push rods in the pressure sensor. These bearings were replaced with plain rollers, and the dash-pot rate was increased to reduce the bottoming velocity of the piston. A second series of low-sinking-speed drop tests was then conducted with the dash pot installed. Although the performance of the unit appeared to be improved over that of the first series of tests with the dash pot installed, it was evident that to gain a more complete and reliable insight into the functioning of a dash pot in series with the high-flotation landing gear, it would be necessary to construct a more refined dash pot or "oleo" strut and to conduct a comparatively extensive drop-test program. It was considered that this course of action should not be followed at that particular time in the research program since it would seriously delay the achieving of the project objectives, the design, development, and determination of the operating characteristics and energy-dissipation capabilities of the high-flotation-tire venting system. It is not to be inferred from the above discussion that satisfactory operation cannot be obtained with the use of a dash pot or oleo strut in series with the high-flotation landing gear.

Drop Tests Conducted With Tire Spin-Up

Table 2 shows the values obtained for the maximum vertical-load factor and maximum spin-up load at various combinations of sinking speed and tire rotational speed for the drop tests conducted at static loads of 788 and 988 pounds and initial tire pressures of 8 and 10 psig, respectively. In the drop tests conducted with a static load of 788 pounds and an initial tire pressure of 8 psig, the maximum vertical-load factors ranged from 1.8 at a sinking speed of 2-1/2 ft/sec and tire rotational speeds of 32 and 63 knots, to 4.1 at a sinking speed of 8-1/4 ft/sec and a tire rotational speed of 63 knots. The maximum spin-up load of 1400 pounds occurred at a sinking speed of 8-1/4 ft/sec and a tire rotational speed of 63 knots. The maximum vertical-load factor attained in the drop tests conducted with a static load of 988 pounds and an initial tire pressure of 10 psig ranged from 1.6 at a sinking speed of 2-1/2 ft/sec and a tire rotational speed of 32 and 63 knots to 3.3 at a sinking speed of 7-3/8 ft/sec and a tire rotational speed of 32 knots. The maximum spin-up load of 1340 pounds occurred at a sinking speed of 6-1/4 ft/sec and tire rotational speeds of 63 and 80 knots.

The maximum spin-up load attained in the drop tests with a tire rotational speed of 63 knots was higher than that attained at a tire rotational speed of 32 knots. In most cases there was little difference between the maximum spin-up load attained at 63 knots and that attained at 80 knots. It is interesting to note that, in the drop test with a static load of 988 pounds, an initial tire pressure of 10 psig, and a sinking speed of 4-3/4 ft/sec, the maximum recorded spin-up load at a tire rotational speed of 63 knots was 1250 pounds while the spin-up load was only 1070 pounds at a tire rotational speed of 80 knots. The reason for this behavior is not known.

Drop Tests Conducted With Wing Lift

Table 3 shows the effect of initial tire pressure and wing lift on the maximum vertical-load factor. The maximum load factors listed are the total load factors applied to the drop-tester carriage and are equal to the sum of the wing lift and tire loads. In the tests with wing lift, the maximum load factor attained at the lower initial tire pressures was, in all cases, slightly lower than that attained at higher pressures. It is not practical, however, to reduce the initial tire pressure below the test values, because the small reduction in the maximum load factor that is realized is more than offset by the greater tire deflection required to arrest the vertical velocity.

The maximum load factor did not vary appreciably between the tests conducted at 50 and 100 per cent wing lift. The drop tests with 0 per cent wing lift were conducted at an earlier date than those with 50 and 100 per cent wing lift and have different sinking speeds than the drop tests with wing lift. The maximum load factor attained in the tests with wing lift was greater than that attained in tests at comparable sinking speeds without wing lift. However, the maximum load carried by the high-flotation tire was smaller in the tests with wing lift than in the tests without wing lift.

The wing-lift cylinders continued to apply wing lift to the unit after the landing impact. This continued application of the wing-lift force after the energy-dissipation cycle caused the tire to leave the ground in the tests with 100 per cent wing lift. The highest such bounce was 3 inches and occurred at a static load of 788 pounds, an initial tire pressure of 10 psig, and a sinking speed of 8 ft/sec.

TABLE 2. MAXIMUM VERTICAL-LOAD FACTOR AND SPIN-UP LOAD FOR DROP TESTS OF THE 750-POUND UNIT CONDUCTED WITH TIRE SPIN-UP

| Aircraft Sinking
Speed, ft/sec | Maximum Vertical-Load Factor
at Indicated Spin-Up Speed | | | | Maximum Spin-Up Load, lb,
at Indicated Spin-Up Speed | | |
|---|--|----------|----------|----------|---|----------|----------|
| | 0 Knots | 32 Knots | 63 Knots | 80 Knots | 32 Knots | 63 Knots | 80 Knots |
| Static Load of 788 Pounds, Initial Tire Pressure of 8 Psig | | | | | | | |
| 2-1/2 | 1.8 | 1.8 | 1.8 | -- | 500 | 800 | -- |
| 3-3/4 | -- | -- | 2.0 | 1.9 | -- | 1100 | 1100 |
| 4-3/4 | 2.4 | 2.4 | 2.3 | 2.4 | 900 | 1100 | 1200 |
| 6-1/4 | 2.8 | 2.9 | 2.9 | 2.9 | 930 | 1310 | 1300 |
| 7-3/8 | 3.3 | 3.3 | 3.4 | 3.5 | 1010 | 1300 | 1250 |
| 8-1/4 | 3.8 | 4.0 | 4.1 | 3.8 | 1200 | 1400 | 1370 |
| Static Load of 988 Pounds, Initial Tire Pressure of 10 Psig | | | | | | | |
| 2-1/2 | 1.45(a) | 1.6 | 1.6 | -- | 650 | 900 | -- |
| 3-3/4 | -- | -- | 2.0 | 2.0 | -- | 1075 | 1100 |
| 4-3/4 | 2.15(a) | 2.3 | 2.2 | 2.1 | 890 | 1250 | 1070 |
| 6-1/4 | 2.5 | 2.8 | 2.8 | 2.9 | 1000 | 1340 | 1340 |
| 7-3/8 | 3.0 | 3.3 | 3.2 | 3.1 | 1180 | 1310 | 1300 |

Note: Constant axle area of 5.7 in.²; total valve area of 10.8 in.²; and zero per cent wing lift.

(a) Eleven psig.

TABLE 3. EFFECT OF INITIAL TIRE PRESSURE AND PERCENTAGE WING LIFT ON MAXIMUM VERTICAL-LOAD FACTOR MEASURED IN DROP TESTS OF THE 750-POUND UNIT

| Initial Tire Pressure, psig | 100 Per Cent Wing Lift | | | 50 Per Cent Wing Lift | | | 0 Per Cent Wing Lift(a) | | |
|-----------------------------|------------------------|----------------------|---------|-----------------------|----------------------|---------|-------------------------|-------------------------|---------|
| | Sinking Speed, ft/sec | Vertical-Load Factor | Maximum | Sinking Speed, ft/sec | Vertical-Load Factor | Maximum | Sinking Speed, ft/sec | Vertical-Load Factor(b) | Maximum |
| Static Load of 788 Pounds | | | | | | | | | |
| 7 | -- | -- | -- | 1-5/8 | 1.8 | 1.8 | 2-1/2 | -- | -- |
| 8 | -- | -- | -- | 1-5/8 | 1.8 | 1.8 | 2-1/2 | 1.8 | 1.8 |
| 10 | -- | -- | -- | 1-5/8 | 2.0 | 2.0 | 2-1/2 | 1.8* | 1.8* |
| 7 | 4-5/8 | 2.6 | 2.6 | 4-7/8 | 2.5 | 2.5 | 4-3/4 | -- | -- |
| 8 | 4-5/8 | 2.8 | 2.8 | 4-7/8 | 2.6 | 2.6 | 4-3/4 | 2.4 | 2.4 |
| 10 | 4-5/8 | 2.8 | 2.8 | 4-7/8 | 2.8 | 2.8 | 4-3/4 | 2.4* | 2.4* |
| 7 | 6-1/2 | 3.1 | 3.1 | 6-5/8 | 3.1 | 3.1 | 7-3/8 | -- | -- |
| 8 | 6-1/2 | 3.3 | 3.3 | 6-5/8 | 3.2 | 3.2 | 7-3/8 | 3.3 | 3.3 |
| 10 | 6-1/2 | 3.5 | 3.5 | 6-5/8 | 3.5 | 3.5 | 7-3/8 | 3.5* | 3.5* |
| 7 | 8 | 3.7 | 3.7 | 8-1/8 | 3.7 | 3.7 | 8-1/4 | -- | -- |
| 8 | 8 | 3.9 | 3.9 | 8-1/8 | 3.8 | 3.8 | 8-1/4 | 3.8 | 3.8 |
| 10 | 8 | 4.3 | 4.3 | 8-1/8 | 4.2 | 4.2 | 8-1/4 | 3.9* | 3.9* |
| Static Load of 988 Pounds | | | | | | | | | |
| 8 | -- | -- | -- | 1-5/8 | 2.0 | 2.0 | 2-1/2 | -- | -- |
| 10 | -- | -- | -- | 1-5/8 | 2.2 | 2.2 | 2-1/2 | 1.5+ | 1.5+ |
| 11 | -- | -- | -- | 1-5/8 | 2.2 | 2.2 | 2-1/2 | 1.45 | 1.45 |
| 8 | 4-5/8 | 2.4 | 2.4 | 4-7/8 | 2.2 | 2.2 | 4-3/4 | -- | -- |
| 10 | 4-5/8 | 2.6 | 2.6 | 4-7/8 | 2.5 | 2.5 | 4-3/4 | 2.1+ | 2.1+ |
| 11 | 4-5/8 | 2.6 | 2.6 | 4-7/8 | 2.6 | 2.6 | 4-3/4 | 2.15 | 2.15 |
| 8 | 6-1/2 | 3.0 | 3.0 | 6-5/8 | 2.9 | 2.9 | 7-3/8 | -- | -- |
| 10 | 6-1/2 | 3.2 | 3.2 | 6-5/8 | 3.2 | 3.2 | 7-3/8 | 3.00 | 3.00 |
| 11 | 6-1/2 | 3.4 | 3.4 | 6-5/8 | 3.2 | 3.2 | 7-3/8 | 3.05 | 3.05 |

Note: Constant axle area of 5.7 in.²; total valve area of 10.8 in.²; and zero spin-up speed.

(a) Tests at zero wing lift were carried out at different drop heights than those with wing lift and are listed as a reference to results previously obtained.

(b) * - 9 psig.

+ - 9 psig, modified valve reported as Valve B in Phase Report dated August 1, 1958.

1500-Pound-Unit Drop-Test Results

As in the drop testing of the 750-pound unit, the initial drop tests of the 1500-pound unit were made at the recommended initial tire pressure of 17 psig. During these tests the impact energy was effectively dissipated, and even though there was some oscillation of the landing gear present after the landing, the unit did not oscillate severely or bounce off of the landing pad as was encountered in the early drop tests with the 750-pound unit. Upon examination of the recorded data, however, it was found that the maximum vertical-load factor obtained in these tests was higher than anticipated.

Effect of Initial Tire Pressure on Maximum Vertical-Load Factor

To reduce the magnitude of the maximum vertical-load factor, drop tests were conducted with lower initial tire pressures. Figure 8 is a graph of maximum vertical-load factor versus initial tire pressure obtained with Valve A for various combinations of sinking speed and static load. These results show that, at the higher sinking speeds, the maximum vertical-load factor was substantially reduced by employing lower initial tire pressure. In the case of the landing with a 920-pound static load and a sinking speed of 7-1/4 ft/sec, the maximum vertical-load factor was reduced from 5.0 to 3.7 when the initial tire pressure was reduced from 21 to 9 psig. As in the case with the 750-pound unit, however, a practical minimum pressure was reached, below which successful higher sinking-speed landings were not possible because the tire was no longer capable of supplying enough impulse to stop the descent of the carriage in the available tire deflection.

The effect of initial tire pressure was not so noticeable at the lower sinking speeds. In the drop tests conducted with a static load of 920 pounds and a sinking speed of 2-1/2 ft/sec, there was essentially no change in the maximum vertical-load factor as the initial tire pressure was varied from 21 to 9 psig. It is interesting to note that, in the drop tests conducted with a static load of 1520 pounds, the maximum vertical-load factor obtained in the lower-sinking-speed landings actually began to increase again as the initial tire pressure was lowered below 13 psig. This resulted from the fact that, in the drop tests conducted with a high static load and with low sinking speed and initial tire pressure, a sufficient impulse was not applied to the unit to bring it to a stop before the tire bleed valve closed. The maximum vertical-load factor in these drop tests occurred after the valve had closed and was higher than the highest load that occurred while the valve was open.

Effect of Valve Area and Programming on Maximum Vertical-Load Factor

The results obtained in drop tests with the three tire bleed valves were fairly similar. There was a small increase in maximum vertical-load factor as the total valve area was reduced, but this increase was not as great as might have been expected. When the valve area was reduced 5.7 square inches from the 24.4 square inches of Valve A to the 18.7 square inches of Valve C, the maximum vertical-load factor obtained in drop tests conducted under the same conditions increased by only one to two tenths. Further reduction in valve area, however, caused the maximum vertical-load

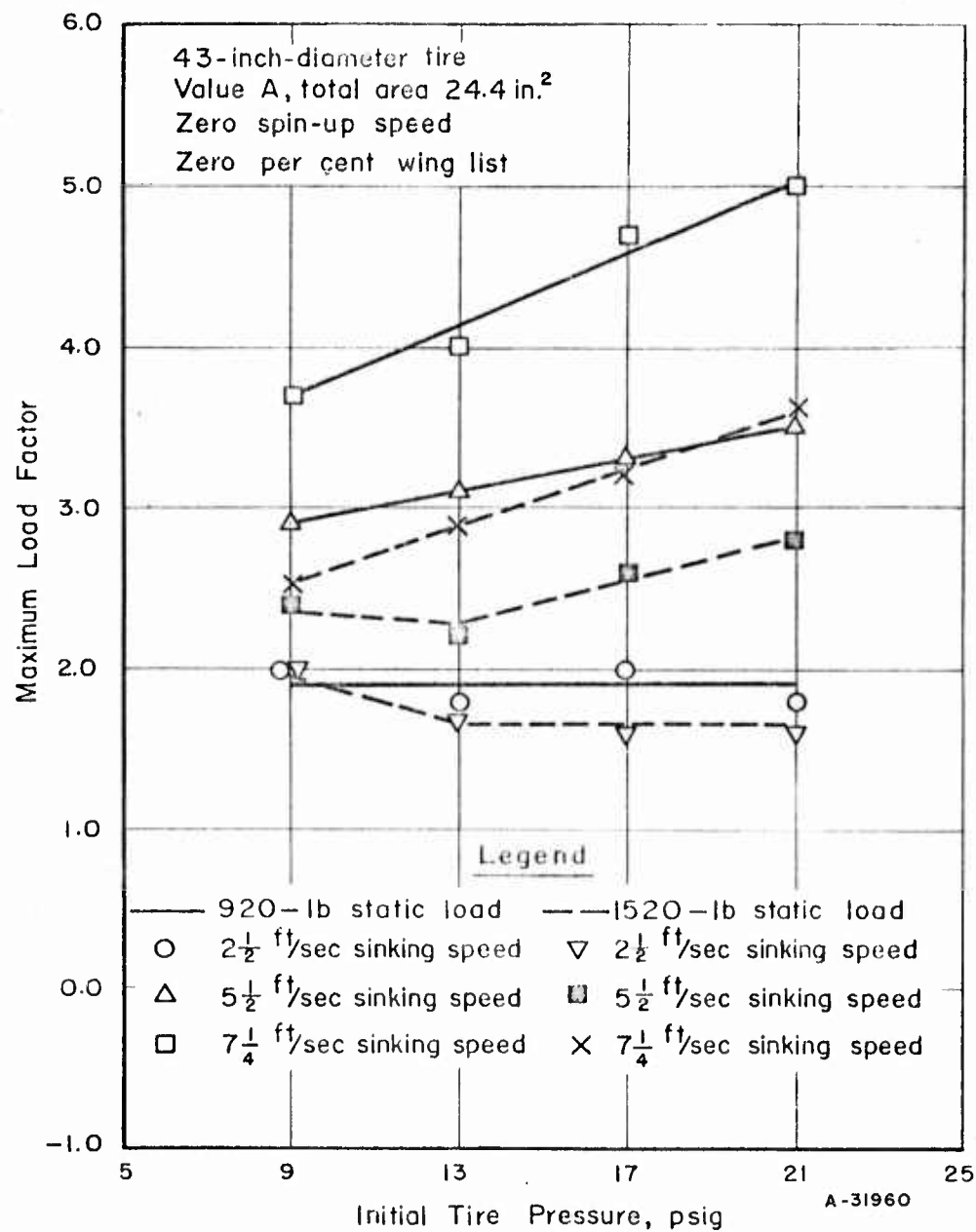


FIGURE 8. EFFECT OF INITIAL TIRE PRESSURE ON MAXIMUM VERTICAL LOAD FACTOR

factor to increase at a slightly faster rate. When the valve area was reduced an additional 4.1 square inches by replacing Valve C with Valve B, which had a total of 14.6 square inches, the maximum vertical-load factor increased by one to three tenths. This seems to indicate that the internal axle area of 17.4 square inches, which is the same for all three valves, and the resistance to air flow encountered in turning the air 90 degrees at the end of the axle limit the flow of air from the tire sufficiently to reduce the effectiveness of valve programming on the 1500-pound unit.

Valve B was eliminated from the testing program after the first sequence of tests because of the higher maximum vertical-load factors achieved with it. Continued testing with Valves A and C indicated that the best over-all performance of the unit with Valve A installed was obtained with an initial tire pressure of 12 psig for a static load of 1500 pounds and 10 psig for a static load of 1200 pounds. With Valve C installed, the best over-all performance was obtained with an initial tire pressure of 11 psig for a static load of 1500 pounds and 9 psig for a static load of 1200 pounds. Since the initial tire pressure used with Valve C was lower than that used with Valve A, the maximum vertical-load factor obtained in drop tests with the two was almost identical, even though Valve A had a larger area. Valve C was chosen to be installed in the unit during the flight tests because its smaller area would probably result in slightly better performance than that achieved with Valve A at sinking speeds below 2-1/2 ft/sec.

Drop Tests Conducted With Tire Spin-Up

The results obtained in the tests conducted with tire spin-up to 61 and 78 knots were in good agreement with those obtained with zero spin-up speed. Table 4 shows the values obtained for the maximum vertical-load factor and maximum spin-up load at various combinations of sinking speed and tire rotational speed for the drop tests conducted at static loads of 1200 and 1500 pounds and initial tire pressures of 9 and 11 psig, respectively. The maximum vertical-load factor obtained at the higher sinking speeds was slightly greater in the tests conducted with tire spin-up than in the tests conducted without tire spin-up. In the drop tests conducted with a static load of 1500 pounds, an initial tire pressure of 11 psig, and a sinking speed of 7-1/4 ft/sec, the maximum vertical-load factor increased from 2.7 in the drop test with zero spin-up speed to 3.1 in the drop test with a spin-up speed of 61 knots. At the lower sinking speeds, however, there was no noticeable difference in the maximum vertical-load factor attained in the tests with and without tire spin-up.

The maximum spin-up load obtained in the drop tests with tire spin-up was 2400 pounds. It occurred in the test conducted with a static load of 1500 pounds, an initial tire pressure of 11 psig, a sinking speed of 10-1/2 ft/sec, and a tire spin-up speed of 78 knots. There was little difference in the maximum spin-up load obtained in tests conducted at spin-up speeds of 61 and 78 knots.

Drop Tests Conducted With Wing Lift

Table 5 shows the effect of wing lift on the maximum vertical-load factor obtained in drop tests conducted at various sinking speeds and tire spin-up speeds. As in the case of the results listed for the drop tests of the 750-pound unit with wing lift, the maximum vertical-load factors listed are the total-load factors applied to the drop-tester carriage and are equal to the sum of the wing lift and tire loads. The maximum

TABLE 4. MAXIMUM VERTICAL-LOAD FACTOR AND MAXIMUM SPIN-UP LOAD OBTAINED IN DROP TESTS OF THE 1500-POUND UNIT CONDUCTED WITH TIRE SPIN-UP

| Aircraft Sinking
Speed, ft/sec | Maximum Vertical-Load Factor
at Indicated Spin-Up Speed | | | Maximum Spin-Up
Load, lb, at Indicated
Spin-Up Speed | |
|---|--|----------|----------|--|----------|
| | 0 Knots | 61 Knots | 78 Knots | 61 Knots | 78 Knots |
| <u>Static Load of 1200 Pounds, Initial Tire Pressure of 9 Psig</u> | | | | | |
| 2-1/2 | 1.7 | -- | -- | -- | -- |
| 3-1/4 | -- | 1.8 | 1.8 | 1100 | 1050 |
| 7-1/4 | 3.1 | 3.1 | 3.0 | 2000 | 1900 |
| 10-1/2 | 4.2 | 4.4 | 4.4 | 2200 | 2300 |
| <u>Static Load of 1500 Pounds, Initial Tire Pressure of 11 Psig</u> | | | | | |
| 2-1/2 | 1.8 | -- | -- | -- | -- |
| 3-1/4 | -- | 1.7 | 1.8 | 1350 | 1350 |
| 7-1/4 | 2.7 | 3.1 | 2.9 | 1900 | 1900 |
| 10-1/2 | 4.0 | 4.1 | 4.0 | 2350 | 2400 |

Note: Constant axle area of 17.4 in.²; Valve C, total area 18.7 in.²; and zero per cent wing lift.

TABLE 5. EFFECT OF WING LIFT AND TIRE SPIN-UP ON MAXIMUM VERTICAL-LOAD FACTOR OBTAINED IN DROP TESTS OF THE 1500-POUND UNIT

| Aircraft Sinking
Speed, ft/sec | Tire Spin-Up
Speed, knots | Wing Lift,
per cent | Maximum Vertical-Load Factor | |
|-----------------------------------|------------------------------|------------------------|--|------------|
| | | | Static Load, lb: 1200
Initial Pressure, psig: 9 | 1500
11 |
| 2-1/2 | 0 | 0 | 1.7 | 1.8 |
| | | 50-40(a) | 1.9 | 1.7 |
| | | 100-80(a) | 1.7 | 1.7 |
| 3-1/4 | 61 | 0 | 1.8 | 1.7 |
| | | 50-40 | 2.0 | 2.4 |
| | | 100-80 | 2.0 | 2.1 |
| 7-1/4 | 0 | 0 | 3.1 | 2.7 |
| | | 50-40 | 3.2 | 2.9 |
| | | 100-80 | 3.2 | 3.0 |
| | 61 | 0 | 3.1 | 3.1 |
| | | 50-40 | -- | 3.1 |
| | | 100-80 | 3.1 | 3.0 |
| 10-1/2 | 0 | 0 | 4.2 | 4.0 |
| | | 50-40 | 4.3 | 4.0 |
| | | 100-80 | 4.4 | 4.1 |
| | 61 | 0 | 4.4 | 4.1 |
| | | 50-40 | 4.3 | 4.5 |
| | | 100-80 | 4.2 | 4.2 |

Note: Constant axle area of 17.4 in.² and Valve C, total area 18.7 in.²

(a) The 1200-pound static-load tests were conducted with 50 and 100 per cent wing lift, and the 1500-pound static-load tests were conducted with 40 and 80 per cent wind lift.

vertical-load factor for the tests conducted at constant sinking speed and static weight was not substantially affected by varying the percentage wing lift or spin-up speed.

In some instances the total maximum vertical-load factor was less in the tests conducted with wing lift than in the tests conducted without wing lift. In the tests conducted at a sinking speed of 10-1/2 ft/sec, a static load of 1200 pounds, and a tire spin-up speed of 61 knots, the maximum vertical-load factor obtained with zero per cent wing lift was 4.4, and that obtained with 100 per cent wing lift was 4.2. Even in the tests in which the maximum vertical-load factor obtained with wing lift was higher than that obtained without wing lift, the maximum load carried by the high-flotation tire was less in the tests with wing lift than in the tests without wing lift.

The continued application of the wing-lift force by the wing-lift cylinders after the energy-dissipation cycle, in addition to the vertical load carried by the high-flotation tire, caused the drop-tester carriage to be accelerated upward after the landing impact. In the drop tests conducted with a static load of 1200 pounds and 100 per cent wing lift, the upward impulse applied to the carriage was sufficient to cause the tire to lose contact with the landing pad and the carriage to lose contact with the wing-lift cylinders. The carriage rose to a maximum height of 2-1/2 inches above the wing-lift-cylinder contact point in the test conducted at a sinking speed of 10-1/2 ft/sec. The carriage did not lose contact with the wing-lift cylinders in any of the tests conducted with a static load of 1200 pounds and 50 per cent wing lift. Except for the test conducted at a sinking speed of 10-1/2 ft/sec and 80 per cent wing lift, the carriage did not lose contact with the wing-lift cylinders in any of the tests conducted with a static load of 1500 pounds.

Optimum Operating Conditions and Range of Sinking Speeds for the 1500-Pound Unit

The best performance of the 1500-pound unit over the full range of sinking speeds was obtained with Valve C and an initial tire pressure of 9 psig for a static load of 1200 pounds and an initial tire pressure of 11 psig for a static load of 1500 pounds. Landings at all sinking speeds from 2-1/2 to 10-1/2 ft/sec were successful under these conditions. Figure 9 shows a graph of the maximum vertical-load factor versus sinking speed for drop tests conducted under these conditions without tire spin-up and wing lift. Except for the tests at extremely low sinking speeds, the maximum vertical-load factor was slightly less in the tests conducted with a static load of 1500 pounds than in those with a static load of 1200 pounds.

Figures 10, 11, and 12 show the landing dynamic characteristics of the 43-inch-diameter high-flotation tire for drop tests conducted with an initial tire pressure of 11 psig, a static load of 1500 pounds, Valve C, zero tire spin-up speed, and zero per cent wing lift at sinking speeds of 2-1/2, 7-1/4, and 10-1/2 ft/sec, respectively. The oscillation of the tire after valve operation, which is dependent on the energy remaining in the system, varied from around 4 inches peak to peak at a sinking speed of 2-1/2 ft/sec to around 1-5/8 inch peak to peak at a sinking speed of 10-1/2 ft/sec. A maximum vertical-load factor of 4.0, which was the allowable design maximum for the gear, was achieved in the 10-1/2 ft/sec landing.

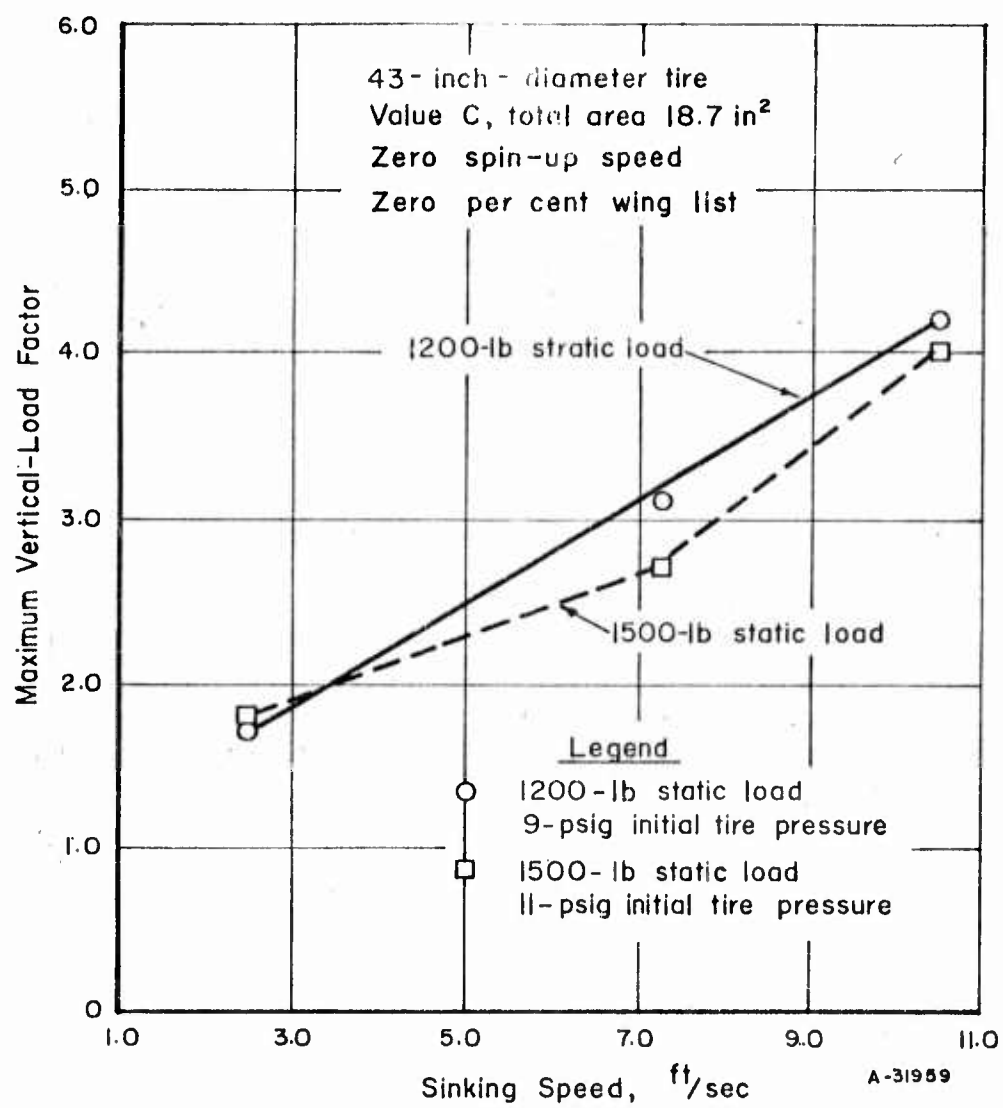


FIGURE 9. RELATION OF MAXIMUM VERTICAL-LOAD FACTOR TO SINKING SPEED

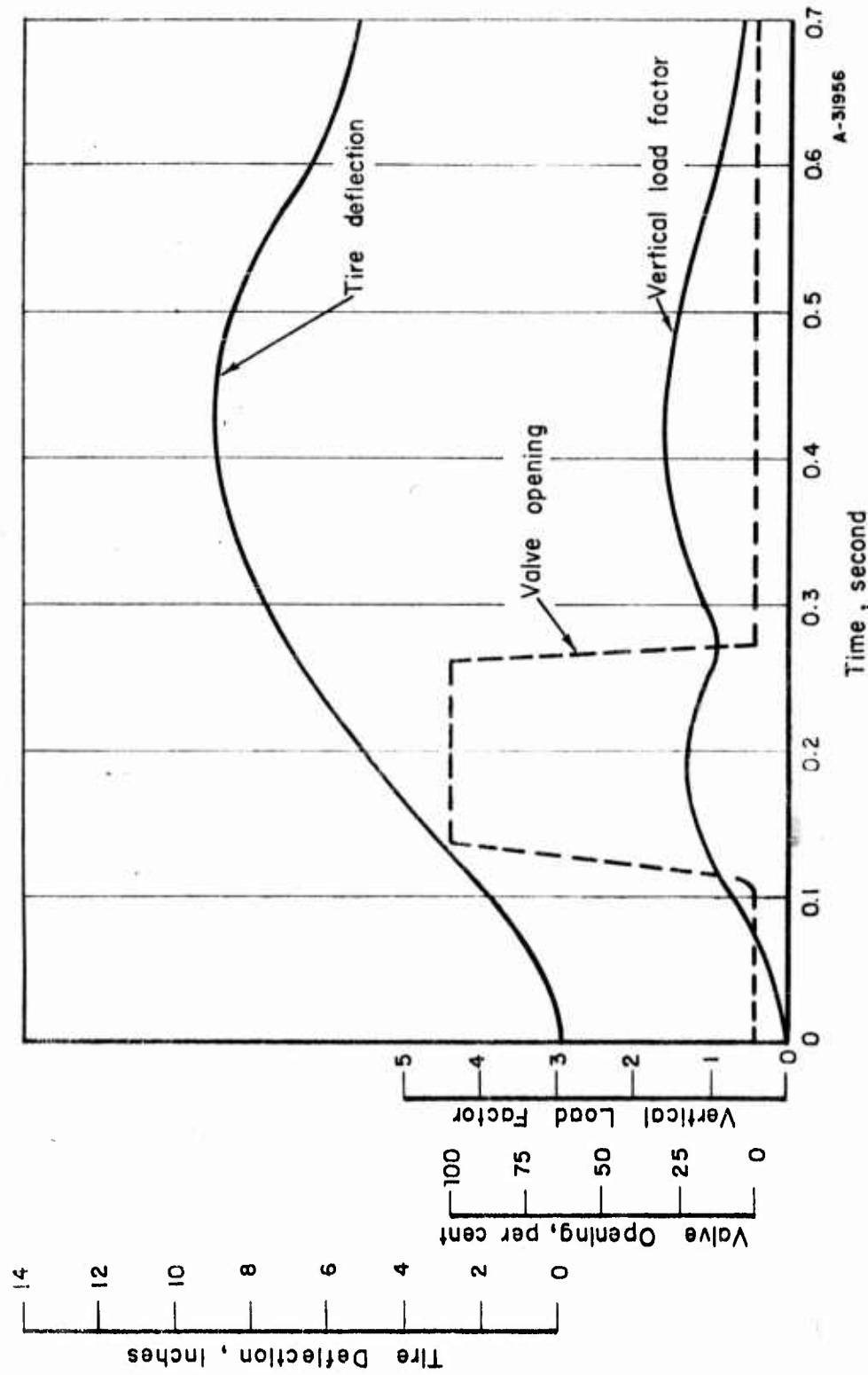


FIGURE 10. LANDING DYNAMICS OF A 43-INCH-DIAMETER, HIGH-FLOTATION TIRE WITH AN INITIAL TIRE PRESSURE OF 11 PSIG, A STATIC LOAD OF 1500 POUNDS, AND VALVE C AT A SINKING SPEED OF 2-1/2 FEET/SECOND

Zero spin-up speed. Zero per cent wing lift. Internal axle area, 17.7 in. ².

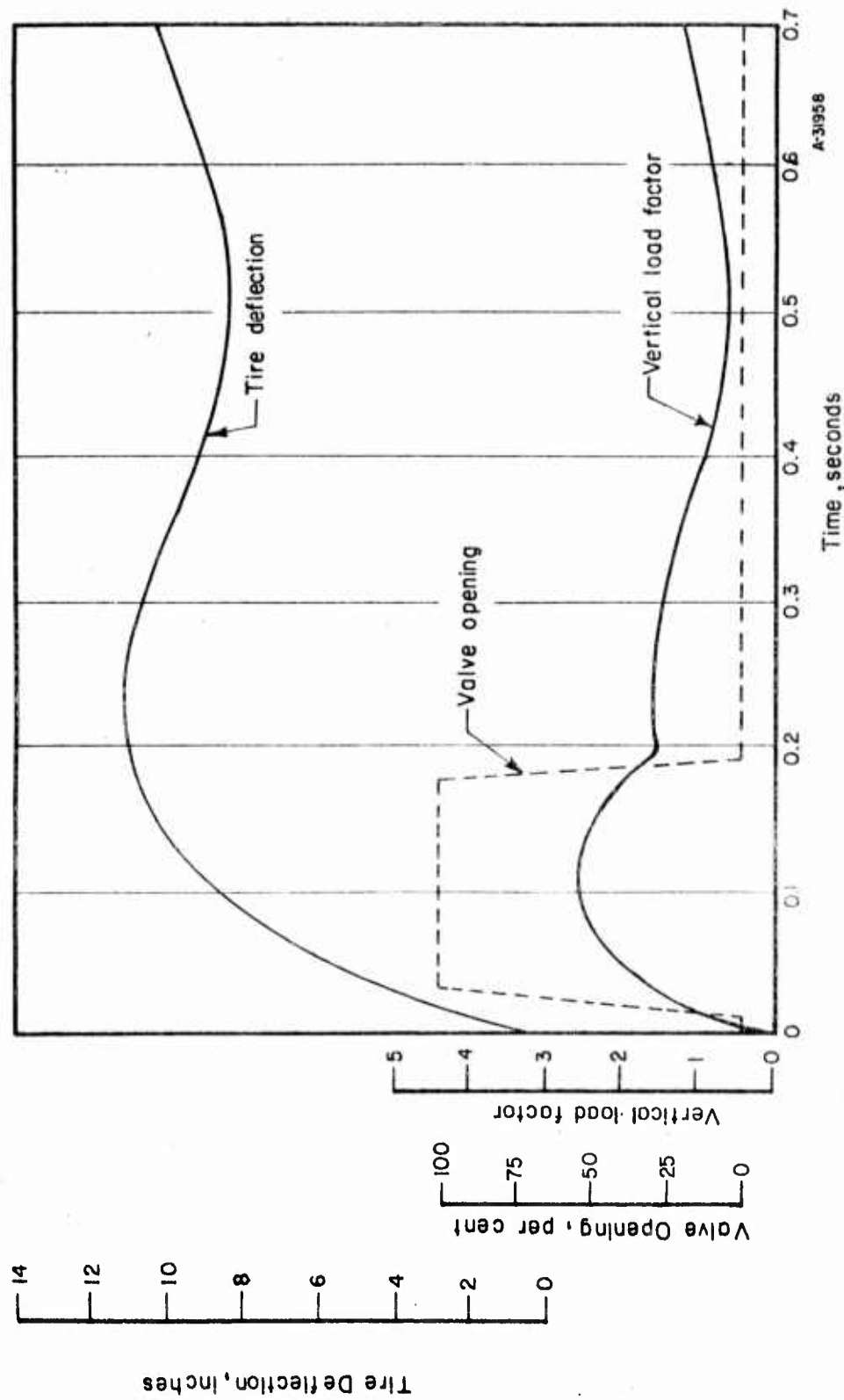


FIGURE 11. LANDING DYNAMICS OF A 43-INCH-DIAMETER, HIGH-FLOTATION TIRE WITH AN INITIAL TIRE PRESSURE OF 11 PSIG, A STATIC LOAD OF 1500 POUNDS AND VALVE C AT A SINKING SPEED OF 7-1/4 FEET/SECOND

Zero spin-up speed. Zero per cent wing lift. Internal axle area, 17.7 in.².

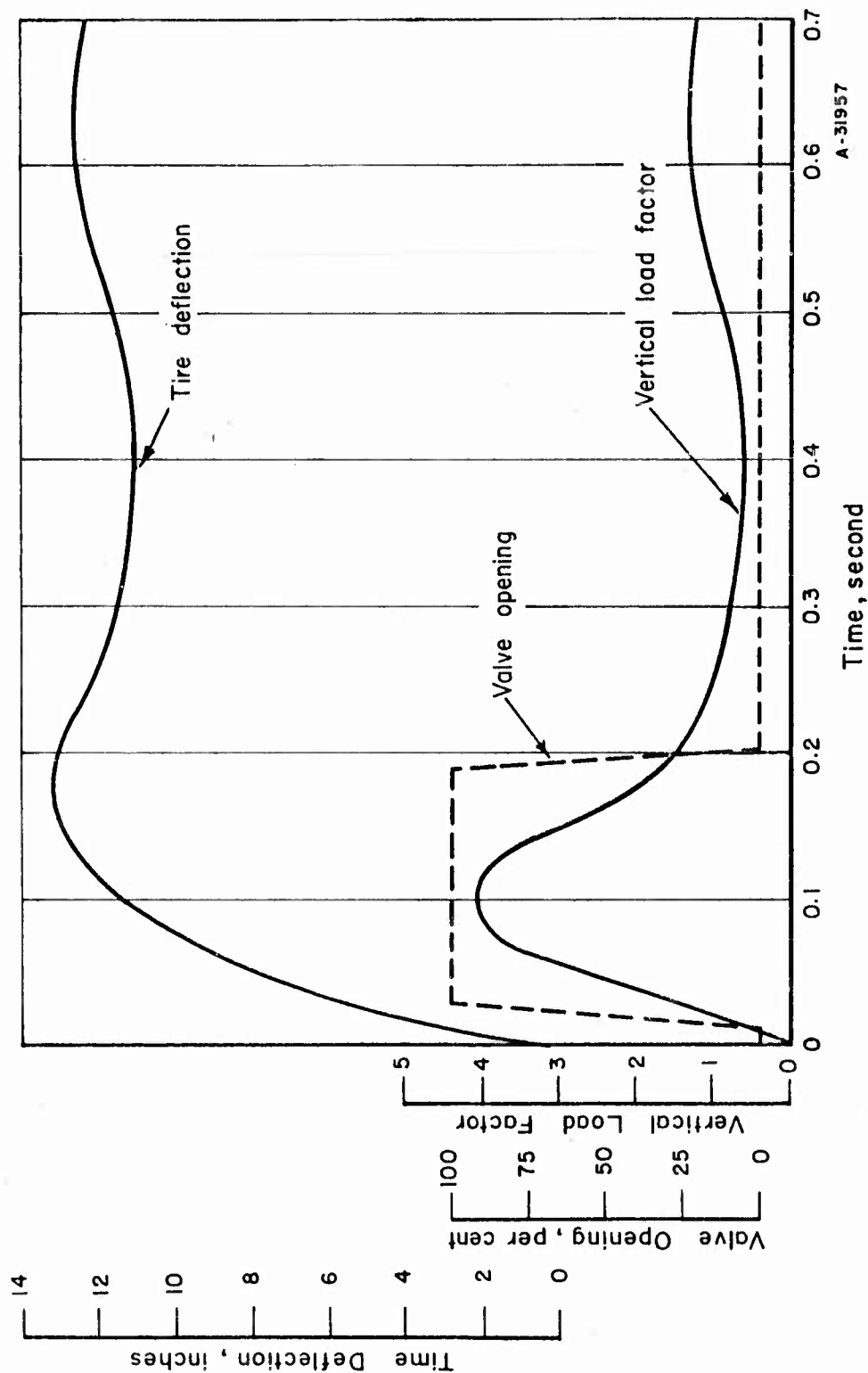


FIGURE 12. LANDING DYNAMICS OF A 43-INCH-DIAMETER, HIGH-FLOTATION TIRE WITH AN INITIAL TIRE PRESSURE OF 11 PSIG, A STATIC LOAD OF 1500 POUNDS, AND VALVE C AT A SINKING SPEED OF 10-1/2 FEET/SECOND

Zero spin-up speed. Zero per cent wing lift. Internal axle area, 17.7 in.².

Final Tire Pressure

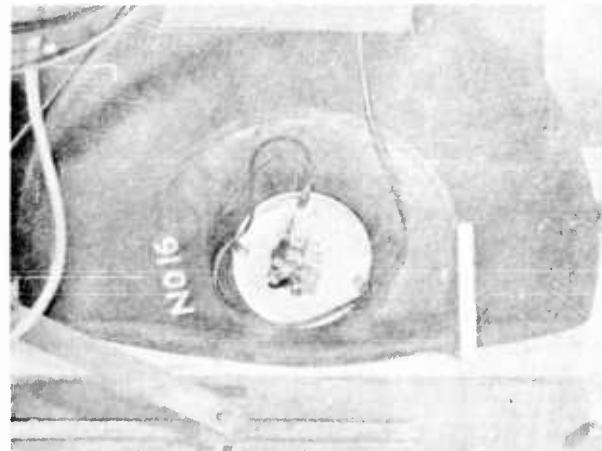
The final tire pressure obtained in drop tests with the 1500-pound unit was affected by sinking speed and by tire spin-up. Final tire pressure decreased with increasing sinking speed and was approximately 1/2 psig higher in the low-sinking-speed drop tests with tire spin-up than in the drop tests without tire spin-up. The increase of final tire pressure with tire spin-up became less significant as the sinking speed increased. In the drop tests conducted with a static load of 1200 pounds, a tire spin-up speed of 61 knots, and sinking speeds ranging from 2-1/4 to 7-1/4 ft/sec, the final tire pressure ranged from 2.5 to 3.9 psig with the final tire pressure increasing with decreasing sinking speed. In drop tests conducted under the same conditions without tire spin-up, the final tire pressure ranged from 2.2 to 3.4 psig.

One of the reasons for this variation in final tire pressure is the difference in tire deflection at the instant of valve closure. As the tire deflection at the instant of valve closure increases, the mass of air retained in the tire decreases and the final equilibrium pressure decreases. Figure 13 is a sequence of photographs of the 43-inch-diameter high-flotation tire with various combinations of static load and tire pressure. At a tire pressure of 3 psig, the tire is still creased when supporting a load of 1500 pounds, but is not creased when supporting a load of 1200 pounds. It requires a tire pressure of approximately 3-1/2 psig to prevent creasing of the 43-inch-diameter high-flotation tire when it is supporting a static load of 1500 pounds.

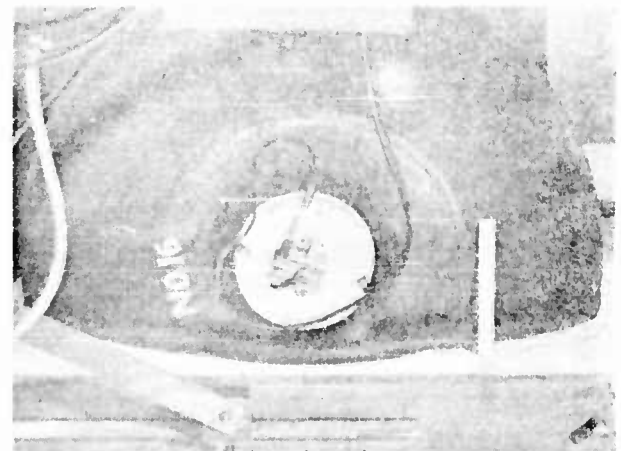
CONCLUSIONS

The conclusions that can be drawn from the test results are:

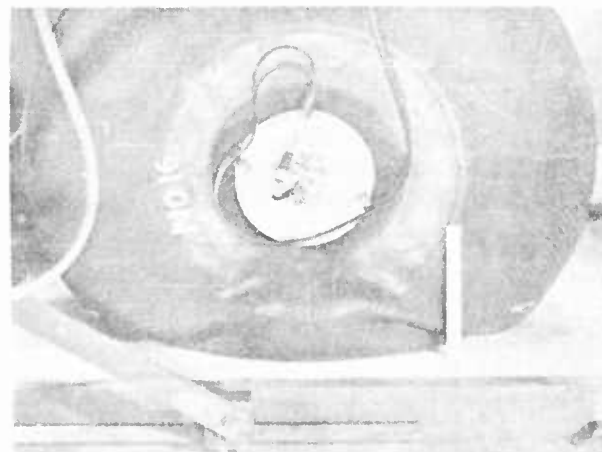
- (1) Both the 750- and 1500-pound static-load high-flotation landing gears are capable of successfully dissipating the landing-impact energy of aircraft under laboratory drop-test conditions.
- (2) The high-flotation landing-gear system is capable of successful laboratory operation with both tire spin-up and wing lift and is not substantially affected by either.
- (3) The present 43-inch-diameter tire unit functions with a maximum vertical-load factor of four or less at sinking speeds as high as 10-1/2 ft/sec with an initial tire pressure of 11 psig, a static load of 1500 pounds, Valve C, zero tire spin-up speed, and zero per cent wing lift.
- (4) It is possible to fold the 43-inch-diameter high-flotation tire into a helical bellows in the manner in which the 34-inch-diameter tire has been folded.



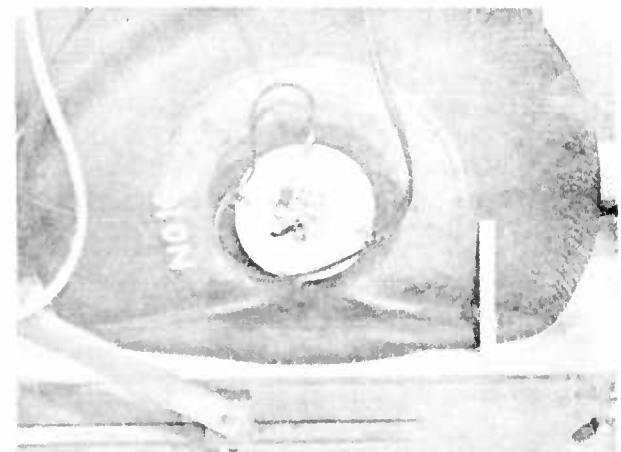
1200 pounds, 1 psig



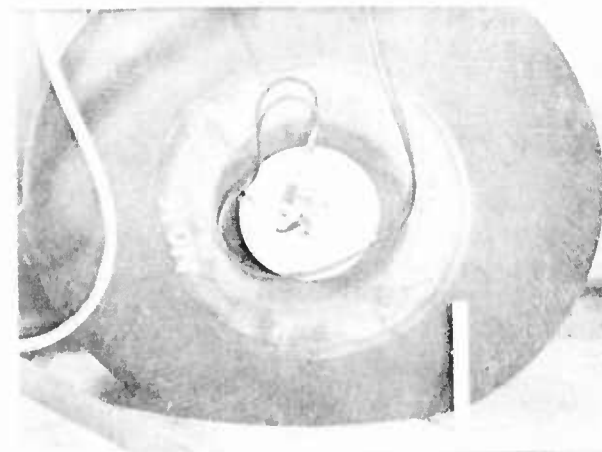
1500 pounds, 1 psig



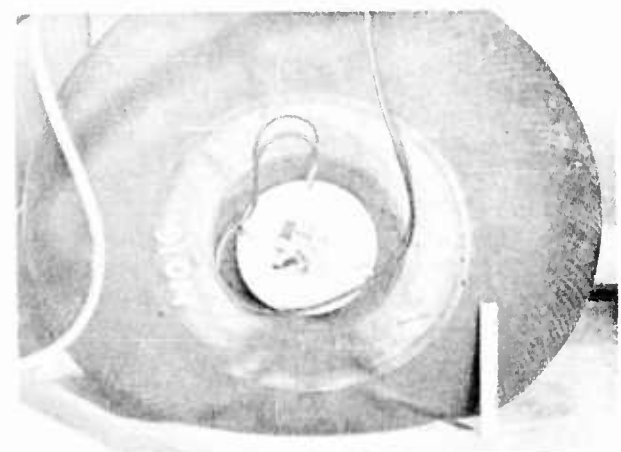
1200 pounds, 2 psig



1500 pounds, 2 psig



1200 pounds, 3 psig



1500 pounds, 3 psig

FIGURE 13. 43-INCH-DIAMETER HIGH-FLOTATION TIRE WITH VARIOUS COMBINATIONS OF STATIC LOAD AND TIRE PRESSURE

FUTURE WORK

Immediate Future

At the present time and in the immediate future, Fairchild will conduct flight testing of the 1500-pound static-load high-flotation landing gear mounted on the L-19 aircraft. Fairchild should consult with Battelle on any problems that occur during this flight-test program. To make this possible, Battelle has submitted to Fairchild, at their request, a proposal for an expansion of the present research program. Under this expanded program, Battelle would be authorized to provide technical assistance to Fairchild during the flight testing and demonstrations of the high-flotation landing gear for the period July 31 through December 31, 1959.

During the testing of the 1500-pound landing-gear unit, full advantage could not be taken of valve programming because the air flow seemed to be limited by the internal axle area of 17.4 square inches and by the resistance to air flow encountered in turning the air 90 degrees at the end of the axle. A better insight as to how the unit might operate with less resistance to air flow could be obtained with the present unit by reducing the volume of air to be bled from the tire during a landing. This could be accomplished by installing a flexible torus, capable of withstanding an inflation pressure of about 25 psig with negligible volume change, inside of the high-flotation tire. The inflated torus would retain the air inside of it and would reduce, by its volume, the volume of air that must be bled down during the landing. Such a torus has already been obtained by Fairchild, and drop testing to determine its performance capabilities could be conducted on the Battelle drop tester.

Future Component Design

The next logical step in the high-flotation landing-gear program is the design and development of an operational unit for use on a specific aircraft. While an operational unit will have to perform the same functions as the present laboratory and flight test unit, it will be necessary to make extensive component changes to simplify their design and to make the unit more applicable to operation under field conditions. The following component-design suggestions are made with this consideration in mind.

Bleed-Valve Design

In an operational unit, it would probably be desirable to have the tire bleed valve located internally rather than externally as it is in the present unit. This would reduce the possibility of the valve being damaged by striking an object during landing or take-off and would decrease the resistance to air flow by eliminating the necessity of turning the air at the outboard end of the axle. The valve configuration itself could take many forms. A sleeve valve similar to the one presently being used could be located internally by mounting the valve sleeves on the inboard side of the tire flange before the tire is wound on it. A pressure-balanced poppet-type valve appears to be attractive, especially if actuated in an inboard rather than an outboard direction.

Component Alterations Necessary for Inboard Valve Actuation

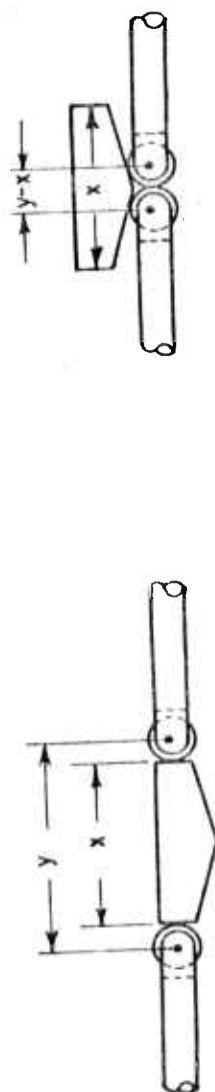
To actuate the tire-bleed valve in the inboard direction, minor changes would be required in the design of the load-sensing cylinder and pressure sensor. The only change necessary in the design of the load-sensing cylinder would be the reversal of the stepped shaft. If the larger diameter of the stepped shaft entered the load-sensing cylinder on the inboard, rather than the outboard side, the stepped shaft would be actuated in the inboard direction when a load was applied to the large piston.

Except for the design of the spacer block, the design and actuation of the pressure sensor could remain essentially as it is. Figure 14 shows the variation in the design of the pressure-sensor spacer block for use with a tire bleed valve actuated in either the outboard or inboard direction. For a valve actuated in the outboard direction, the spacer block holds the valve "push" rods apart during valve actuation and reduces their effective length by a distance, x , when the pressure sensor disengages. For a valve actuated in the inboard direction, the spacer block would hold the valve "pull" rods together during valve actuation and would increase their effective length by a distance, x , when the pressure sensor disengaged.

Load- and Pressure-Sensor Cylinder

In the present unit, the closing of the tire bleed valve when a given minimum tire pressure is reached is accomplished by the removal of a spacer block from the valve push-rod assembly to shorten the effective length of the assembly. This spacer block could be eliminated and the same method of valve closing could be retained by the removal of the hydraulic link in the load-sensing cylinder from the valve push-rod assembly. Figure 15 is a schematic sketch of a proposed load- and pressure-sensor cylinder. The operation of the cylinder would be as follows:

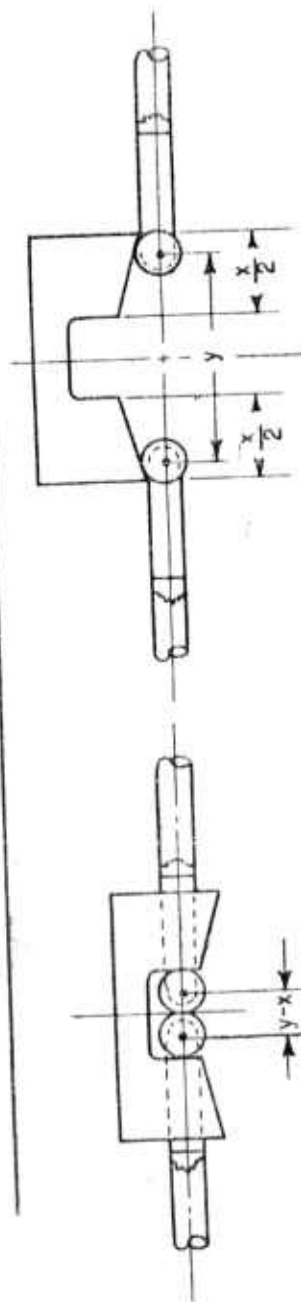
- (1) With the landing gear in the extended position, the weight of the tire and axle would pull the large piston to the top of the cylinder.
- (2) The gas, which would be separated from the hydraulic fluid by a bladder or membrane in the lower accumulator chamber, would expand and force the hydraulic fluid through the control spool valve into the upper chamber.
- (3) When the tire pressure reached the pressure-sensor cocking pressure, the control valve would be actuated to the engaged position and would close off the upper chamber from the lower accumulator chamber.
- (4) Upon landing, the closed-off upper chamber would perform in the same manner that the present load-sensing cylinder does and the tire bleed valve would be actuated.
- (5) When the tire pressure dropped to the pressure-sensor disengaging pressure, the control valve would be actuated to the disengaged position, as shown in Figure 15, and the upper chamber would again be open to the lower accumulator chamber.



Spacer Block Engaged

Spacer Block Disengaged

Spacer block design used in present 1500 - pound landing - gear unit with tire bleed valve actuated in the outboard direction



Spacer Block Engaged

Spacer Block Disengaged

Spacer block design for use with tire bleed valve actuated in the inboard direction

A-32037

FIGURE 14. VARIATION IN THE DESIGN OF THE PRESSURE-SENSOR SPACER BLOCK FOR USE WITH A TIRE BLEED VALVE ACTUATED IN EITHER THE OUTBOARD OR INBOARD DIRECTION

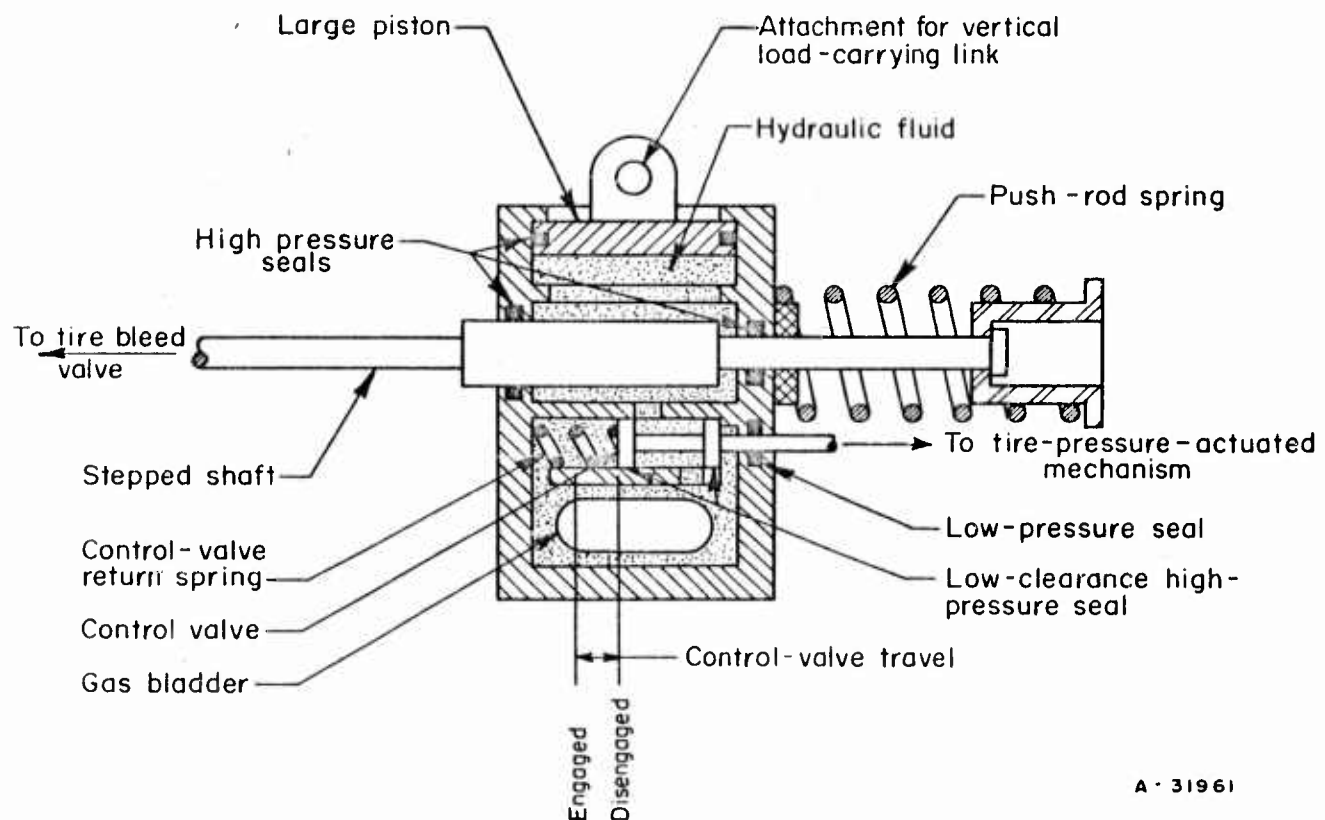


FIGURE 15. PROPOSED LOAD- AND PRESSURE-SENSOR CYLINDER

- (6) The hydraulic fluid in the upper chamber would be forced into the accumulator chamber, compressing the gas bladder. The larger diameter portion of the stepped shaft would be pulled back into the cylinder by the push-rod spring, thus closing the tire bleed valve, and the vertical load on the large piston would force it into the cylinder until it bottomed on a stop.

The area of the control valve would have to be large enough to permit the hydraulic fluid displaced in the upper cylinder by the bottoming of the large piston and by the re-entrance of the larger portion of the stepped shaft to flow into the accumulator chamber in from 0.01 to 0.02 of a second. To reduce and to maintain at a fairly constant value the force required to actuate the control valve, it would probably be beneficial to use an extremely low clearance, metal-to-metal fit on the sealing surfaces of the control valve. Such an arrangement would permit a small amount of leakage, but since the upper cylinder would be pressurized for only a fraction of a second during valve actuation, a small amount of leakage could be tolerated. At the point where the control-valve shaft emerges from the accumulator chamber a low-pressure, low-friction, zero-leakage seal could be used.

The control valve could be actuated in a number of ways. One method would employ the bellofram-piston and cam straps that are presently used. In this system the control valve could simply replace the U-shaped, pressure-sensing guide block and could be actuated by the cam strap in the same manner that this block presently is. Another method would be to actuate the control valve by a small solenoid which could be energized by a pressure switch or switches located in the tire.

In the design of any future load-sensing cylinders, attention should be given to the cushioning of the stepped shaft and large piston when they bottom on their respective stops. A neoprene seat is provided on the stepped shaft stop of the present unit, but a shock load is still applied in both the axial and vertical directions when the stepped shaft bottoms on this stop.

A record of all technical work performed on this project appears in Battelle Memorial Institute Laboratory Record Books 13510, 13511, 14103, and 15296.

WFP:RDF:JHB:CWR:JAH:JEV:RJM/mmk

FAIRCHILD AIRCRAFT AND MISSILES DIVISION

H A G E R S T O W N 10, M A R Y L A N D

SUBJECT INITIAL FLIGHT TESTS
HIGH FLOTATION LANDING GEAR



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A. J. Atkinson
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I. INTRODUCTION

The purpose of these tests was to evaluate the functional and aerodynamic characteristics of the Fairchild High-Flotation Landing Gear, Model M-245B, as outlined in the test program.

The test program was completed in two phases. The initial testing was terminated on 4 August 1959 due to the contract funds being expended. A continuation of the contract was received which authorized the completion of testing and expanded the landing program to include sinking speeds of up to 10 fps in place of a maximum of 7.25 fps previously agreed upon.

II. SUMMARY AND CONCLUSIONS

A. General Conclusions

1. Test data presented in this report show that the M-245B landing gear has exceptional capability in absorbing obstacle and landing loads. These qualities, together with the high-flotation capabilities evaluated briefly in soft soil and mud, indicate that the operating conditions of military support aircraft can be greatly expanded by adaptations of this landing gear.
2. Further tests are recommended to obtain sufficient data for design of satisfactory struts to adapt this gear to operational aircraft and explore the rough field characteristics with additional gear damping provisions. It is unlikely that these tests, including landing and take-off across an array of obstacles, can be made on the present L-19 test bed because of aircraft structural limitations and the rigid strut installation.
3. The flight tests outlined in Reference (a) program were completed within the safety and structural limits of the gear and airplane with the exception of the highest rate of descent landings which exceeded by 0.15 g the airplane design load factor of 4.0 g. No damage was sustained by the gear or the airplane during these tests. The most significant conclusions from flight tests are as follows:

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II. SUMMARY AND CONCLUSIONS

A. 3. - continued

a. The limiting obstacle height for the 43-inch tire (1500 lb capacity) is approximately 6 inches for low speed or STOL aircraft operating at ground speeds in the range up to 40 or 45 mph. Obstacles 8 inches high could be satisfactorily crossed at low taxi speeds. Tests were limited by drag strut springback obstacle loads although the 8-inch obstacle loads indicate a considerable increase in strut strength would be required to make a take-off or landing over this size obstacle. (Refer to Figure 9.)

NOTE: The loads presented in graphs of this report are referenced as noted in the Background section of this report, Paragraph 7.

b. Venting tire pressure at touchdown to absorb landing shock and loads is feasible although some revision of the valving is considered desirable for improvement of gear efficiency.

c. An operational installation of the gear should include some provisions for damping of rebound noted in high rate of descent landings and when taxiing through wide ditches.

d. Taxiing through mud, in which a 4-wheel drive jeep stalled, was satisfactory. However, operation under these conditions resulted in mud being thrown into the propeller by the tires and subsequently being blown over the aircraft, including the windshield. In an operational concept for propeller driven aircraft some provision would have to be made to eliminate or minimize this problem.

e. Tire folding in flight was successfully accomplished following the installation of an internal tube arrangement to assist in the dynamic folding of the tire.

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II. SUMMARY AND CONCLUSIONS

B. Detailed Test Results

1. The M-245B landing gear with 43-inch tire operated satisfactorily and without malfunction in tests which included the following maximum conditions:
 - a. Taxiing over rectangular 2 1/8 inch obstacle at 41 mph.
 - b. Taxiing over rectangular 4 1/4 inch obstacle at 37 mph.
 - c. Taxiing over rectangular 6 3/8 inch obstacle at 38 mph (Photo 35-390).
 - d. Taxiing over rectangular 8 inch obstacle at 8 mph (Photo 35-388).
 - e. Taxiing across 24 x 4 inch ditch at 36 mph.
 - f. Taxiing across 24 x 6 inch ditch at 30 mph.
 - g. Taxiing across 24 x 8 inch ditch at 15 mph (Photo 35-182).
 - h. Landing at 10.25 fps rate of descent.
 - i. Taxiing on mud approximately 6 inches deep (soil bearing strength too low to support a man's weight).
 - j. Taxiing on soft soil.
 - k. Landing and taking off from rough sod.
2. Normal accelerations obtained in taxi tests were well within the 4 g aircraft limits in tests over obstacles up to 6 3/8 inches at the highest speeds tested. This is shown in Figures 21, 22 and 23. Figure 23, for example, shows 2.3 g acceleration at 22 mph and 2.1 g acceleration at 37 mph in 6 3/8 inch obstacle tests.

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II. SUMMARY AND CONCLUSIONS

B. 2. - continued

Lateral and longitudinal accelerations are presented in the same plots. Acceleration data for 8-inch obstacle tests, presented in Figure 24, indicate no problem to 8 mph, (maximum 1.6 g, vertical) the speed at which tests were limited by drag strut loads. Time history plots of aircraft accelerations are presented for tests over obstacles in Figures 25 through 34, taxiing across ditches in Figures 44 through 53, and landings in Figures 59 and 604. Vertical load factor versus sinking speed in landing tests verifies drop-test data as shown in Figure 54.

3. Gear vertical loads in taxi tests over obstacles of varying size at incremental tire pressures and speeds are presented in Figures 17 through 20. These plots show total vertical load, (rolling plus vertical component due to drag), and vertical load prior to obstacle contact is also shown for reference. Total vertical loads only are shown in the time history plots (figures referenced in paragraph 2). Vertical motion of the hub when taxiing over 6 3/8 inch obstacles at 2.7 psi tire pressure was negligible as recorded by motion picture. Photo 35-390 shows the obstacle enveloped by the tire with negligible vertical displacement of the hub. Obstacle absorption is also shown in Photo 35-388 - left gear on 8-inch obstacle, right gear on 6 3/8-inch obstacle.
4. Drag strut incremental loads for obstacle runs are presented in Figures 10 through 13 with drag load due to main gear reaction also shown for reference. Effect of tire pressure on incremental drag loads is shown in Figures 14, 15 and 16 which are crossplots of drag load data. Drag strut springback loads, which were the limiting factor in taxi tests, are presented in Figures 8 and 9. The drag strut loads in the time history plots referenced in paragraph 2 are total axial loads. In designing struts for an operational use of this gear, the drag strut loads of this report should be considered and total drag loads resulting from simultaneous obstacle contact and touchdown (not tested in this program) will also be a factor in determining structural strength. For initial drag loads at touchdown, see Figure 55.

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II. SUMMARY AND CONCLUSIONS

B. Detailed Test Results - continued

5. In landing tests the gear absorbed vertical loads at touchdown with about the same efficiency as demonstrated in drop tests. Figure 54 compares drop test and landing test data, showing a c.g. load factor of 4.15 with a landing at 10.25 feet per second. This landing is also plotted as a time history (Figure 60A) which shows the need for damping of rebound after initial touchdown. (Note vertical loads and c.g. load factor on time history plots, Figures 59, 60 and 60A). Additional vertical load data on landing is presented in Figures 56, 57 and 58.
6. The quick-reinflation system used in these tests (description on Page 17) apparently is needed only for high rate of descent landings when pressure after tire venting at touchdown is less than 2.5 psi. Several landings were made without quick reinflation at rates of descent approximating 5 fps. The landing bounce tendency was not noticeably changed. Since the quick-reinflation system may increase tire pressure to as much as 4 psi after a light landing (3.0 or 3.5 residual pressure plus 1.0 or 0.5 psi reinflation) it could result in pressure at which obstacle absorption is considerably lessened. In Figures 59, 60 and 60A the tire pressures during quick reinflation are presented to show time of operation. Gage location is such that only stabilized pressure readings are accurate.
7. Taxiing over obstacles of 6 to 8 inch height on level terrain the tire deflects at low pressures to absorb the obstacles satisfactorily. For satisfactory operation over wide ditches (4 or 5 ft width) or rolling ground, additional damping would appear necessary on aircraft with one wheel on each main gear.

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II. SUMMARY AND CONCLUSIONS

B. Detailed Test Results - continued

8. In-flight folding of the tire was satisfactory at 95 knots following modification of the folding system. The modification consisted mainly of the addition of an inflated internal diagonal tube arrangement to prevent premature collapse of the leading surface of the tire during the first stage of the folding cycle.

In the original configuration diagonal ribs (fastened to the outside of the tire for economy purposes on the test article) produced satisfactory folding on the ground. However, when the tire was suspended in the airstream at 85 knots the ribs on the leading surface collapsed, destroying the diagonal convolutions required for proper folding. By removing the external ribs and adding an inflated internal rib system satisfactory results could be obtained.

9. Control of the airplane in flight with the M-245 gear installed was qualitatively satisfactory in take-off, climb, cruise and stall configurations. Longitudinal controllability was marginal immediately following high rate of descent landing impact. This was due to tail wheel bounce and the undamped oscillation of the tires following touchdown and was corrected by adding a small amount of engine power. Ground handling was satisfactory although maneuvering on pavement is slightly more difficult than the original gear especially when a pivoting turn is attempted.

10. A speed-power check was made and data presented in Figure 61 indicates that the gear and struts reduced airspeed at cruise power (approximately 2200 rpm, 130 BHP) by 23 mph, from 112 to 89 mph. This is applicable only to the test-bed which included fixed gear with heavy struts and strut fairings (reference Photo 35-388).

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II. SUMMARY AND CONCLUSIONS

B. Detailed Test Results - continued

11. Take-off performance data analysis presented in Table I shows that the figures presented in the L-19 pilot's manual for take-off and climb over 50 ft obstacle were matched within the limits of measuring accuracy. The test data plots are Figures 62 through 66.
12. Leakage through the tires and around hub seals will require much improvement for a production type or the aircraft will need a built-in set of jacks. With pressure from the reservoir shut-off, the test tires lost pressure completely in several hours. It was not possible to determine whether there was leakage through the rotary seals of the pressure-sensing element because of the other leaks noted above.
13. Extensive landing gear load data, for both the normal and high-flotation gear, appears in tabulated form in Appendix I of this report.

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III. DISCUSSION

A. Background

1. The M-245B High-Flotation Landing Gear with 43 inch tire (1500 lb rated capacity) was tested by the Fairchild Structural Test Laboratory as reported in reference b, (static tests) and reference c (rolling tests). Drop tests were conducted by Batelle Memorial Institute, Columbus, Ohio, as reported in reference d.
2. In order to obtain comparative data the L-19A furnished for gear tests was instrumented and tested briefly before installing the M-245B landing gear. Gross weight was 2400 lb for all tests, ± 30 lb of fuel, and c.g. was 33.5% m.a.c.
3. As a result of drop test findings and pre-test conference on operating procedures it was considered necessary to redesign part of the inflation system. This redesign, made for the reasons listed below, delayed the program only slightly since it was found that a simplified inflation system, adequate for taxi tests, could be installed and that refinements of the system for flight could be made later when design and drawings were completed. The changes from original plans required were as follows:
 - a. Interconnection of tires was considered unacceptable because it would permit air from one tire to flow to the other tire in cross-wind taxiing or with other lateral load differences. To eliminate interconnection and still retain the feature of post-landing bleed-down to a preset roll-out pressure it was necessary to duplicate the system from the tire to the pilot's adjustable regulator (including the regulator).

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III. DISCUSSION

A. 3. - continued

b. Drop tests indicated that a roll-out problem could be anticipated because of the variation of post-landing tire pressure with rate of descent which is illustrated as follows:

| Rate of descent | Residual tire pressure |
|-----------------|------------------------|
| 2.25' fps | 3.6 psi |
| 7.25 " | 2.6 " |
| 10.5 " | 1.8 " |

It appeared that with less than 3 psi and a 1200 lb load the tire would wrinkle excessively for roll-out. To correct this problem a smaller reservoir (650 cu. in) was added to the system. This "quick-reinflation" reservoir charged to approximately 200 psi, would discharge into the tires immediately after touch-down, raising tire pressure by approximately 1 psi. This reinflation value could be varied by the charge of the quick-reinflation reservoir. Pressure would then bleed down, through bleeds in the adjustable regulators, to the pressure selected by the pilot for roll-out.

c. The system as originally designed was considered unsafe for flight tests since it required a pilot, upon landing and during roll-out, to adjust two regulators (from 9 psi to roll-out pressure of approximately 3 psi) and push a button to reactivate the inflation system. In order to correct this and permit the pilot to select the roll-out pressure while on base leg or final approach two solenoid valves were added between the tires and regulators. These valves closed when the pilot selected the "Land" position on the gear control box and the pilot could then adjust the regulators to the roll-out tire pressure. After landing, the valves

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III. DISCUSSION

A. 3. c. - continued

were reopened by a pressure-operated time delay switch. The solenoid valves also prevented back pressure during quick-re-inflation from damaging the regulators.

4. The M-245B system as installed on the L-19A did not include the tire deflation and folding provisions since these tests were programmed for completion on a large airplane. The initial in-flight folding tests were conducted on a C-119 airplane S/N 53-3136, using a specially constructed rig to lower the tire into the airstream through the paratainer door opening.

5. The weight of the control components on the test-bed installation was not representative of a possible production model. These parts such as regulators, solenoid valves and pressure piloted valve were off-the-shelf items selected for quick availability and a low cost test installation.

6. In order to obtain comparable weight with the various test configurations the c.g. of the airplane was practically dictated by the gear installation and the ballast space available. For determination of weight and c.g. the airplane, with instrumentation installed, was weighed in the level attitude (levelling on the control torque tube) in the original configuration, after installing the M-245B gear and again after installing the quick-reinflation system with flight control panel.

a. Tests of the original gear configuration were made with a full fuel load but with instrumentation recording equipment installed at the observer's station and ballasted with 25 lb on the battery, 133 lb around the legs of the pilot's seat and 70 lb aft of the seat (horizontal arm 144.0). The airplane with pilot weighed

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III. DISCUSSION

A. 6. a. - continued

2400 lb with c.g. 33.6% m.a.c. The highest weight listed for L-19 aircraft in T.O. 11-19A-5 is 2100 lb at 30.5% m.a.c. and the same T.O. lists the aft c.g. limit of the L-19E as 31.0% m.a.c. at 2400 lb. The aircraft manufacturer was contacted and approval was obtained to use 33.6% m.a.c. as a test loading providing no spin maneuvers were planned and vertical load on the gear should be limited on landing to 7300 lb, (2100 lb x 3.47 g).

- b. The installation of the M-245B gear with simplified inflation system and instrumentation allowed only 7 gallons of fuel for 2400 lbs, c.g. 27.5% m.a.c. Fuel was considered adequate for taxi operations.
- c. When the final system was installed the airplane was overweight. The air compressor, chemical air dryer and related tubing were removed and the accumulator was charged from an external compressor unit before each flight. Instrumentation was changed to use a small dry-cell bridge battery. With 11 gallons of fuel the aircraft loading was 2429 lbs, c.g. 29.8% m.a.c. Limited by space and structure for mounting instrumentation and inflation equipment, this was considered the optimum obtainable with a reasonably safe fuel supply.

7. The zero references for load data presented in Figures 1 through 7 for the original gear were taken in flight. The high flotation gear zero references were obtained before and after test by jacking the airplane and disconnecting the drag struts for Ground runs 1 through 12. After installation of the flight system the zero references were recorded in flight immediately prior to landing or, in the case of obstacle tests, during a lift-off from the runway. An exception is the tire pressure which was obtained with the aircraft on jacks and tire pressure bled to zero.

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III. DISCUSSION - continued

B. Test Comments

1. Original L-19A Configuration with Standard Gear

- a. All tests listed in the program were conducted except the turning radius test which was discontinued when it was found that the steerable tail wheel controlled the radius of turn for approximately a 20° turn, then swivelled to permit practically a pivot at low speed and an incipient ground-loop. Thus it appeared that significant turn data could not be obtained.
- b. Obstacle tests were carried to a maximum of 23 mph over a 2 x 6 inch plank. (Reference Figures 1 through 5.) These standard-gear loads were considerably higher than those of reference (e). It is noted that the tests of reference (e) were conducted at 2135 lb gross weight while Fairchild tests were at 2400 lb. The wide variation of gear load prior to obstacle contact is considered a result of changes in wing lift and in thrust vectors due to necessary throttle adjustments in obtaining the desired speeds (reference Figures 1, 2, 4 and 5).
- c. Landings were made to a maximum rate of descent of 4.3 fps which were adjudged by the pilot as limiting by reason of gear deflection (reference Figures 6 and 7). Vertical loads on the gear were higher than those of comparable descent rate in the reference (e) report, probably due to weight difference. Longitudinal accelerations were practically identical to reference (e) while vertical accelerations for given descent rates were approximately 0.25 g lower.

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III. DISCUSSION

B. 1. Original L-19A Configuration with Standard Gear - continued

d. Data for comparison with the M-245B gear were also obtained for the remaining items of the test program which included speed-power (Figure 61), performance take-off and landing (Figures 62, 63 and 64 and Table I) and pivoting turns on sod and concrete. The latter data was not plotted since the high-flotation gear was not instrumented for side loads and torsion loads.

2. M-245 Landing Gear (simplified inflation system)

a. Tests with the simplified system (excluding parts required for flight test) were made over obstacles and ditches of varying sizes as reported in the summary and conclusions. Gross weight was 2400 lb with c.g. 27.5% m.a.c. When it became evident that maximum obstacle runs scheduled would result in exceeding the 2300 lb limit in the aft drag strut fitting, it was necessary to monitor loads and approach the high speed runs in cautious increments, with resulting delay in the program.

b. The tire pressure originally desired for test was 3.5 psi, a pressure which reduced wrinkling of the tire. This is also the pressure which remains in the tire after a light landing, consequently that at which obstacle contact can be anticipated. As seen in Figures 8 and 9, this pressure severely limited the speed at which obstacles could be negotiated within drag springback load limits of the drag strut fitting (originally 2300 lb). This total drag load results from the geometry of the gear which, in 3-point attitude positions the main strut forward of the strut attachment and introduces a 400 lb tension component in the drag strut due to 950 lb vertical static load.

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III. DISCUSSION

B. 2. b. - continued

The vertical load increased dynamically when the airplane crossed an obstacle and spring-back loads of the fixed strut were additive. Drag strut incremental loads are presented in Figures 10 through 13 independent of vertical load reaction in the drag strut.

c. Obstacle tests were continued using a tire pressure of 2.7 psi after a brief exploration showed that rolling characteristics at this pressure would be acceptable although wrinkling was more than desired and the greater deflection of the tire resulted in premature wear. The anticipated tread width of the tire had been reinforced with a sheet of tread-stock neoprene approximately .060 inch thick. The sidewall area, where wear was encountered at low pressure, was covered only with .020 inch of relatively soft carcass-stock neoprene. On a production type tire of this size, if operation at pressure as low as 2.7 psi is desired, the tread width should be increased approximately 5 inches on each side of the tire.

d. Taxi tests over obstacles higher than 2 1/4 inches were limited to one obstacle (reference Photo 35390) in accordance with the test program provision covering danger to the airplane. It became obvious that in the repeated runs between two obstacles the tail wheel would eventually be damaged. On one occasion the tail wheel struck a 2-inch obstacle when using paired obstacles. In later demonstrations at slow speed a 6 inch and 8 inch obstacle were negotiated simultaneously without difficulty to demonstrate that no longitudinal control problem resulted. (Photo 35-383.) The obstacles used for tests were rectangular, as shown in the referenced photo, and no ramp was used.

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III. DISCUSSION

B. 2. M-245 Landing Gear (simplified inflation system) - cont'd

e. The considerable scatter in gear vertical load data appears characteristic of low pressure tires when compared with data of reference (e). The vertical load data of Figures 17 through 20 is total load and the rolling load, also plotted, may be subtracted to obtain incremental loads due to obstacles.

f. Taxi tests across a ditch were made over a 2 ft by 4 ft box buried flush with the ground and filled with planks to vary the depth and width of the ditch. The 4 ft dimension (length) remained constant and the taxi path was across the 2 ft dimension (width) which was varied to 18 inches and 12 inches (Photo 35-182). The taxi tests across the ditch were conducted to limits of safe operation or to speeds at which loads recorded had reached maximums. As seen in Figures 35 through 43 the ditches 12 inches or 18 inches wide presented no problem at depths up to 6 inches. The ditch 24 inches wide and 8 inches deep resulted in sharply increased springback drag loads (Figure 37), vertical loads (Figure 40) and aircraft accelerations (Figure 43). Time history plots of vertical loads, drag loads and aircraft accelerations are presented for evaluation of dynamic characteristics in Figures 44-53.

3. M-245 Landing Gear, Complete Inflation System

a. Tests with the complete inflation system, including quick-reinflation but without folding provisions, were made in accordance with the program. Gross weight was 2400 lb (± 30 lb fuel) with c.g. 29.8% m.a.c. Increments of descent rate were obtained for landing tests by increasing the height of the landing

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III DISCUSSION

B. 3. a. Continued

flare and stall. Attempts were also made to increase rate of descent by using forward stick at the time of the stall. The best results were obtained by use of 60° flaps, setting up a nose high, power-on approach and varying the height at which the engine was cut to control sinking speed.

- b. After five flights with the quick-reinflation accumulator charged to 100 psi (resulting in 1 psi quick reinflation) the regulator for this accumulator was set to a minimum (60 psi) for approximately 0.7 psi quick reinflation. No significant change in gear or aircraft reaction was noted. However, this explains the lower pressure of Figure 60 compared with Figure 59 during the quick-reinflation period.
- c. Initial landing tests were complicated by reason of the original tail wheel spring. At 2400 lbs gross weight a hard landing bent the original spring on several occasions. The first of two series of landing tests was terminated at a maximum sinking speed of 6.4 fps to preclude damage to the airplane through failure of the tail wheel spring.

A new tail wheel spring was supplied by TRECOM and installed on the airplane prior to the final landing tests. This spring was made of a slightly heavier gauge material than the original and held up well at the maximum attained sinking speed of 10.25 fps.

- d. During the landing tests it was decided to reinforce the aft drag strut attachments. This change was simply a bracket attaching to the skin and an additional rib, increasing the limit for drag springback (tension) load from 2300 to 3500 lb. With this configuration it

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III. DISCUSSION

B. 3. d.- continued

was possible to increase speed over obstacles as indicated by flagged test points on various plots. There was also noted a tendency to reduced springback loads for a given speed and tire pressure after stiffening the drag strut attachment. This may be seen, for example, on Figure 9.

e. Landing tests for recorded data were made on a macadam runway. Two landings were made for qualitative evaluation of characteristics on a rough sod field. No problems of control or rolling characteristics on rough sod were noted but the undamped bouncing when taxiing at 15-20 mph through a ditch about 6 inches deep and 5 feet wide was quite pronounced. Bouncing was also noted when taxiing on a "washboard" macadam surface.

f. Take-off was made from a macadam runway except one case when a take-off was made from a rolling stretch of rough sod. In the latter case the absence of damping was also notable on the test bed installation. No recording was made of load or acceleration data during the rough field take-off because of generator trouble at the time. Further tests were anticipated under more strenuous conditions but contract funds were expended before this could be accomplished.

g. It will be noted that side loads and torsion loads on the gear strut were not obtained. The gear structure was too heavy to obtain measurable deflections with the weight of the L-19 aircraft. This also eliminated measurement of turning loads on the gear and restricted such tests to qualitative evaluations.

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III. DISCUSSION

B. 3. M-245 Landing Gear, Complete Inflation System - cont'd

h. Several drops were made from a crane in order to determine that the quick-reinflation system and valves were functioning satisfactorily before making a landing. Data is presented in Figure 54. During one of these drops the rudder of the aircraft was damaged and a replacement was obtained from TRECOM.

C. Description of Test System

1. **Original Landing Gear**

The original landing gear was unchanged from the standard L-19A configuration. Strain gages were installed for measurement of loads.

2. **M-245B Landing Gear (Simplified Inflation System)**

Pending engineering changes considered necessary for the flight tests a simplified inflation system was installed for the early phase of taxi tests. This system included a main reservoir (capacity 870 cu. in., 3000 psi) with regulators for individual tire pressure selection. The tires and hubs were in final configuration as related to ground operation.

3. **M-245B Landing Gear (Flight Test System)**

As finally installed the gear included, in addition to the above reservoir and regulators, the following:

a. **Quick reinflation system** consisting of a reservoir (capacity 650 cu. in.) which filled to an adjustable pressure (for early tests, 100 psi) when a pressure sensor cocked. It discharged into the tires when both pressure sensors uncocked after touchdown.

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III. DISCUSSION

C. 3. M-245B Landing Gear (Flight Test System) - continued

b. Indicators

- (1) Red warning light indicating that a pressure sensor was not cocked and ready for landing, light extinguished when both were cocked.
- (2) Green indicator lights, one for each tire indicating when the tire pressure sensor was cocked and ready for landing.

c. Selectors

- (1) Pressure regulators for selecting touchdown tire pressure or taxi pressure. These had adjustable stops set for 9 psi touchdown and approximately 3 psi for taxiing over obstacles. A mid-point selection for approximately 5 psi was used for taxiing on smooth surface and for take-off to avoid excessive tire wear.
- (2) Control panel with electrical switch set for "cruise" position during in-flight tire inflation for landing. The switch was set to "Land, Taxi and T.O." position just prior to landing and this closed solenoid valves between the tires and the regulators so that the regulators could be set to 3 psi before landing. Without these valves the tire pressure would begin bleeding back through the regulators when they were set to roll-out pressure before landing. The solenoid valves also protected the regulators from the higher line pressures during quick-reinflation. The solenoid valves were automatically opened approximately 5 seconds after touchdown by an adjustable time-delay switch.

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III. DISCUSSION

C. 3. M-245B Landing Gear (Flight Test System) - continued

d. Compressor

A compressor provided for the system was installed but it was found that with the instrumentation recording equipment the airplane would exceed 2400 lbs. Since a 2500 psi charge in the main reservoir was adequate for approximately 4 inflations of the tires, the compressor was removed and the reservoir was charged from a ground compressor unit prior to tests. This unit incorporated filters and chemical dryers. For a production system using 43-inch tires, it is believed that a compressor with 1500 psi or less capacity would prove adequate.

4. Operation of the Flight Test System, Typical

- a. Prior to take-off the pilot adjusts the regulators to 5 psi, places the control switch to "Land, Taxi and T.O.". Since sensors are not cocked the solenoid valves remain open and the tires inflate to 5 psi.
- b. After take-off the pilot places the control switch to "Cruise" position and pushes the regulators to the forward stops (preset to 9 psi). Red light indicates, and green lights do not, while tires inflate. When one tire reaches cocking pressure (approximately 7.5 psi) a green light comes on, red light remains on, the quick reinflation system reservoir (solenoid controlled) fills to preset pressure, and pressure continues to the tires. When the other tire reaches cocking pressure the corresponding green light comes on and the red light is extinguished. Pressure to the tires continues to increase to 9 psi and is maintained at that pressure.

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III. DISCUSSION

C. 4. Operation of the Flight Test System, Typical - cont'd

- c. On final approach, the pilot places the control switch to "Land, Taxi and T.O.", pushes regulator controls full aft to the stops and is ready for landing. Solenoid valves are now closed to prevent pressure bleeding through regulators from the tires.
- d. At touch-down the tires exhaust to between 3.5 and 2.1 psi, depending on rate of descent, pressure sensors uncock individually when pressure sensor senses 2.5 psi inside the hub. (The variation in actual tire pressure results from the difference in volume of air exhausted from the tire when deflection at touchdown is large or small.) When the second pressure sensor uncocks the quick re-inflation system discharges the quantity of air in the 650 cu. in. reservoir into the tires (100 psi equals approximately 1 psi tire pressure increase) and triggers the time-delay relay. After the preset time-delay the solenoid valves are reopened between the tires and regulators and the pressure of the tires is increased or bled off to the value preset by the regulator low pressure stop (approximately 3 psi).
- e. After roll-out the pilot places the regulators approximately mid-way between the stops for a 5-psi taxi pressure on smooth terrain or leaves the regulators on the low pressure stop for taxiing on rough, unprepared surface.

D. Instrumentation

Instrumentation was provided on the M-245B gear to record on an oscillograph as follows:

Drag loads of the gear, from strain gages on the eyebolt stem attaching the drag strut to the main strut assembly.

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III. DISCUSSION

D. Instrumentation - continued

Vertical loads from strain gages on the vertical load links.

Vertical acceleration, from an accelerometer mounted on the floor and attaching to aircraft rib structure 22 inches aft of the firewall (over the main gear).

Longitudinal acceleration, from an accelerometer mounted adjacent to vertical accelerometer.

Lateral acceleration, from an accelerometer mounted on a board installed aft of the pilot's seat 49 inches aft of firewall, on centerline of the aircraft. This was directly below the mid-point of the wing root chord.

Tire pressure, from transducers installed in the inflation lines to the valves approximately 5 feet upstream of the tires. Thus, when measuring pressure during quick-reinflation of the tires (Figures 59 and 60) the measurement was actually line pressure until pressure stabilized. No completely satisfactory method could be found for measuring actual tire pressure since pressures inside the hub are also affected by air flow during tire inflation and venting. Comparison of vertical load and tire pressure in Figures 59 and 60 shows however that the lag in time between vertical load actuating the vent valve (approximately 1000 lb) and the drop in tire pressure (venting through hub) is approximately .02 second. Tire pressures stabilize about 2 seconds later upon completion of quick reinflation. This was satisfactory for determining proper functioning of the inflation system.

Ground speed, from a microswitch mounted on tail wheel to indicate each revolution of the wheel, with time correlation on oscillograph for rpm.

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III. DISCUSSION

D. Instrumentation

Rate of descent was measured by equipment utilizing the reflection from the runway surface of a continuous audio tone projected from the aircraft. The principle of operation is as follows: Dependent on the distance traveled, the reflected sound will either tend to reinforce or cancel the projected sound as picked up by a microphone located near the source. The relative output level of the microphone is recorded on an oscillograph and, with the frequency used in these tests, peaks occur at approximately every two inches as the aircraft approaches the runway. Since time is also on the oscillograph record, rate is easily computed. Correction is made in the calculations for the effect of variation of the speed of sound with temperature.

Instrumentation for visual recording was as follows:

RPM, Free Air Temperature, Cylinder Head Temperature, Airspeed and Oil Temperature from standard aircraft instruments.

Manifold Pressure, Ranco, Inc. gauge, S/N AF 43-107717, calibrated for operating range. Pressure tap was in the line between the primer and the engine (primer inoperative).

Tire Pressure downstream of regulators, calibrated gauges.

Reservoir Pressure of main inflation system, gauge in outlet line reading to 3000 psi for the 870 cu. in. reservoir.

Regulated Air Pressure (to 200 psi) gauge in line between reservoir outlet regulator and tire inlet regulators.

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III. DISCUSSION

D. Instrumentation - continued

Reservoir Pressure (to 200 psi) quick-reinflation system, gauge between reservoir outlet and solenoid valve controlling release of air to the tire.

Regulated Air Pressure (to 160 psi) gauge on regulated controlling air to the quick-reinflation reservoir.

E. Tire Folding Test Apparatus

Ground and in-flight folding and reinflation tests of the high flotation tire were conducted by means of a portable test rig. This rig contained the necessary supply of compressed gas, a vacuum pump, a means of raising and lowering the tire in the slipstream when airborne, and necessary controls. The test rig was so designed that it could be installed in the cargo hold of a C-119 airplane and the tire could be lowered into the airstream through the paratainer doors in the bottom of the fuselage.

Initial attempts to fold the tire in flight failed when the original configuration (external diagonal ribs) collapsed at its leading surface when lowered into the slipstream. The external ribs were removed and an internal tube arrangement was installed which assisted the dynamic folding of the tire.

The inner tube arrangement consisted of two tubes having a 3 1/2 inch diameter cross section and 21 inch outside diameter mounted inside the tire carcass, concentric with the axle. Ten inflatable internal ribs of 2 1/4 inch diameter cross-section were installed diagonally between the two inner tubes. Air lines connected the tube arrangement to the supply and evacuating sources.

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III. DISCUSSION

E. Tire Folding Test Apparatus - cont'd

The tire and the internal tube arrangement were inflated separately. During the folding sequence the tire was deflated and the internal ribs held the tire as the inner hub began its rotation. As the hub rotation continued, the internal ribs propagated the diagonal convolutions required for proper folding. Once the diagonal folds were initiated the internal tube was deflated and the hub completed its rotation to complete the sequence. Refer to Photos 36-918 through 36-921.

IV. REFERENCES

- Fairchild Report No. FTE-201A, Flight Test Program, High Flotation Gear System (M-245) 18 April 1958, Revision C, 25 February 1959, as amended by letter TREC-AA9-89-02-000 ST 140 AV from Lt. Col. Steinkrauss to FAMD, March 25, 1959.
- Fairchild Engineering Report No. R245-010, Static Test - High Flotation Tire, 19 February 1959.
- Fairchild Engineering Report No. R245-011, Rolling Tests - High Flotation Tire.
- Batelle Memorial Institute, Summary Report, The Design and Development of Laboratory and Flight-Test Models of Landing Gear for Aircraft to be Operated from Rough Unprepared Fields, August 15, 1959.
- Goodyear Aircraft Report GER 9061, Rough Terrain Landing Gear Evaluation Program, 31 October 1958.

Figure 1

EFFECT OF GROUND SPEED ON VERTICAL LOAD

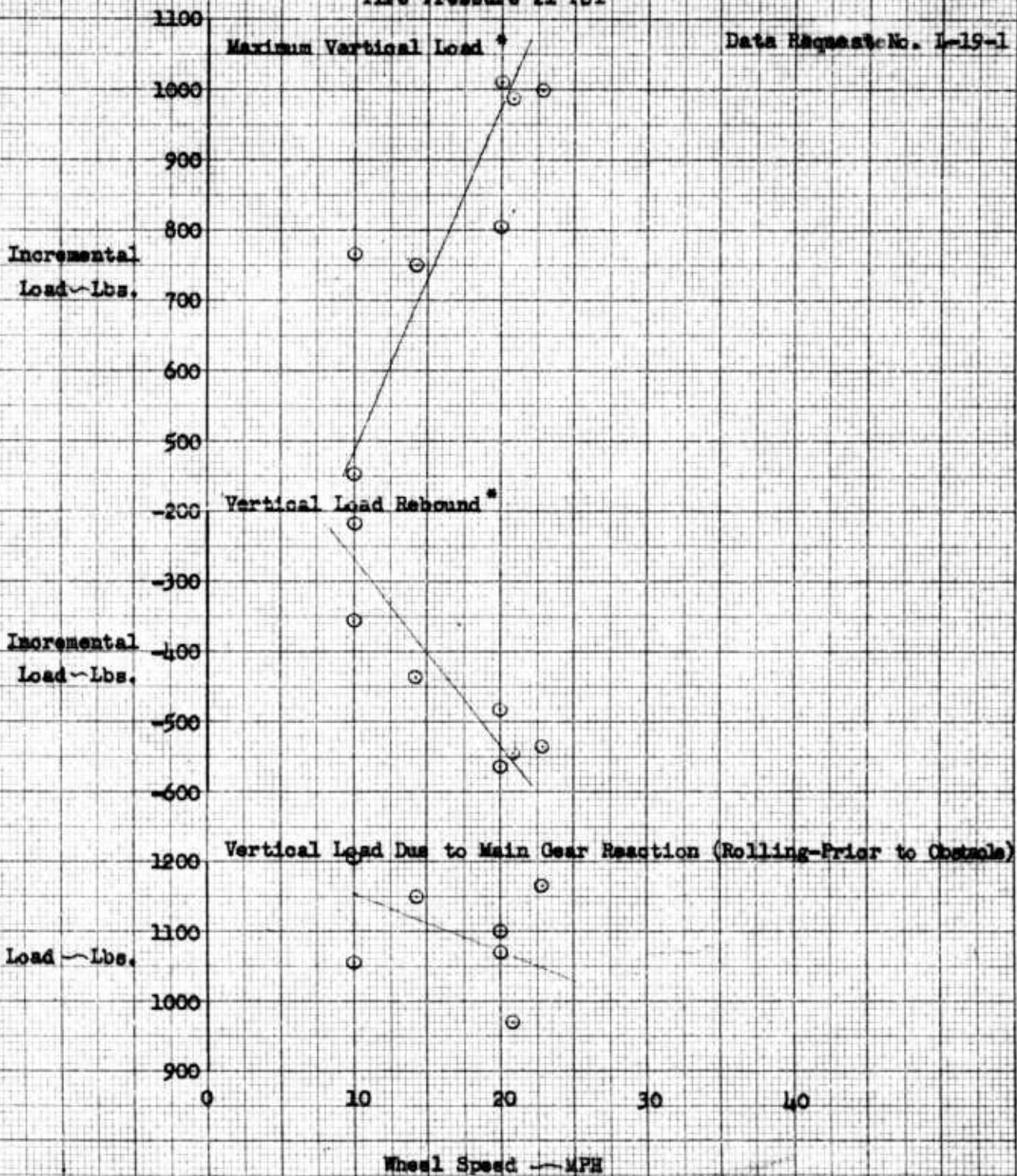
Over 2 1/8" Obstacle

L-19A Flight No. 1-19-2 S/N 51-7441 April 29, 1959

Original Tire and Landing Gear

Tire Pressure 21 PSI

Data Request No. 1-19-1



* Limit Load is 3644 lbs.

Figure 1

EFFECT OF GROUND SPEED ON VERTICAL LOAD

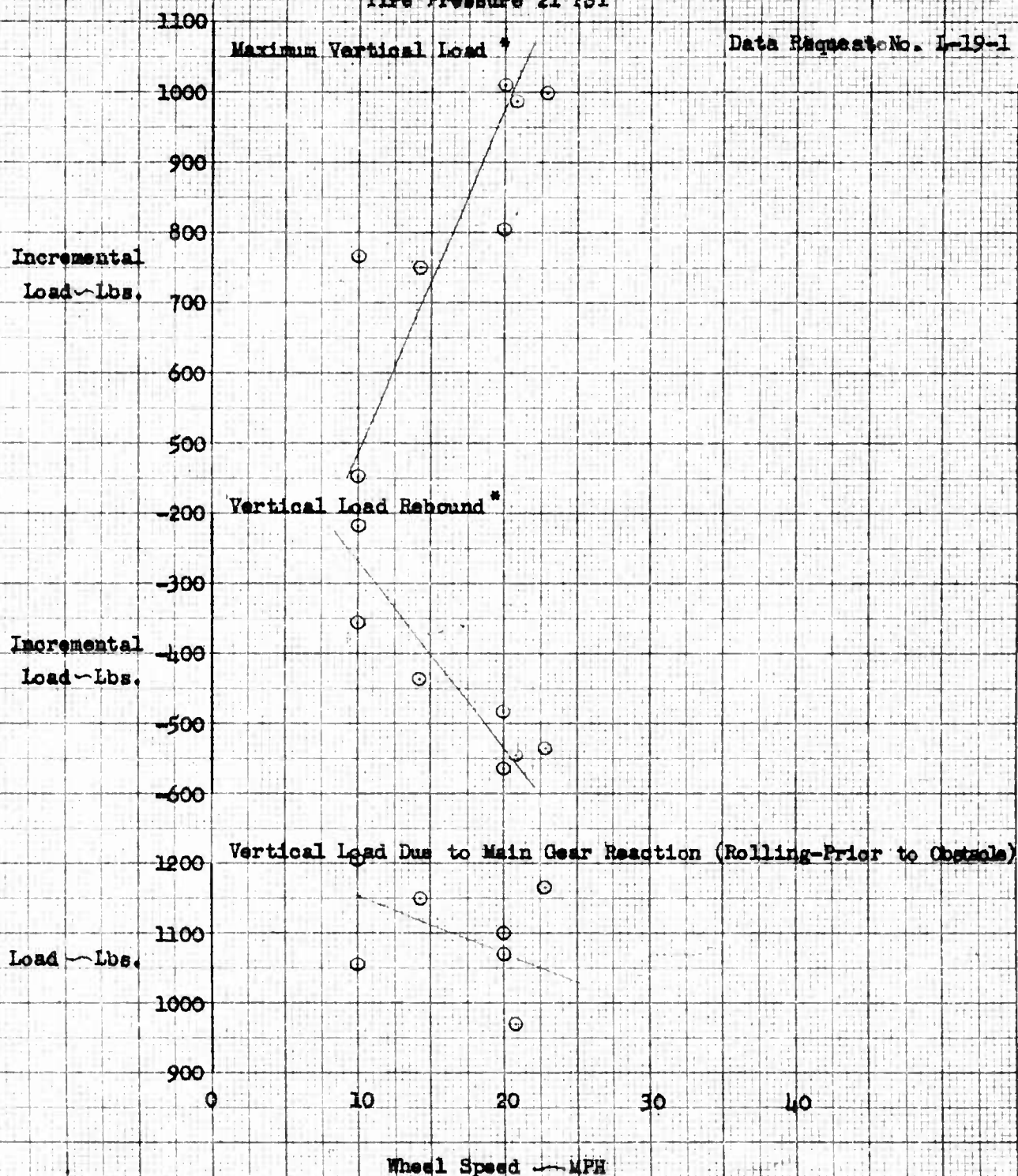
Over 2 1/8" Obstacle

I-19A Flight No. I-19-2 S/W 51-7441 April 29, 1959

Original Tire and Landing Gear

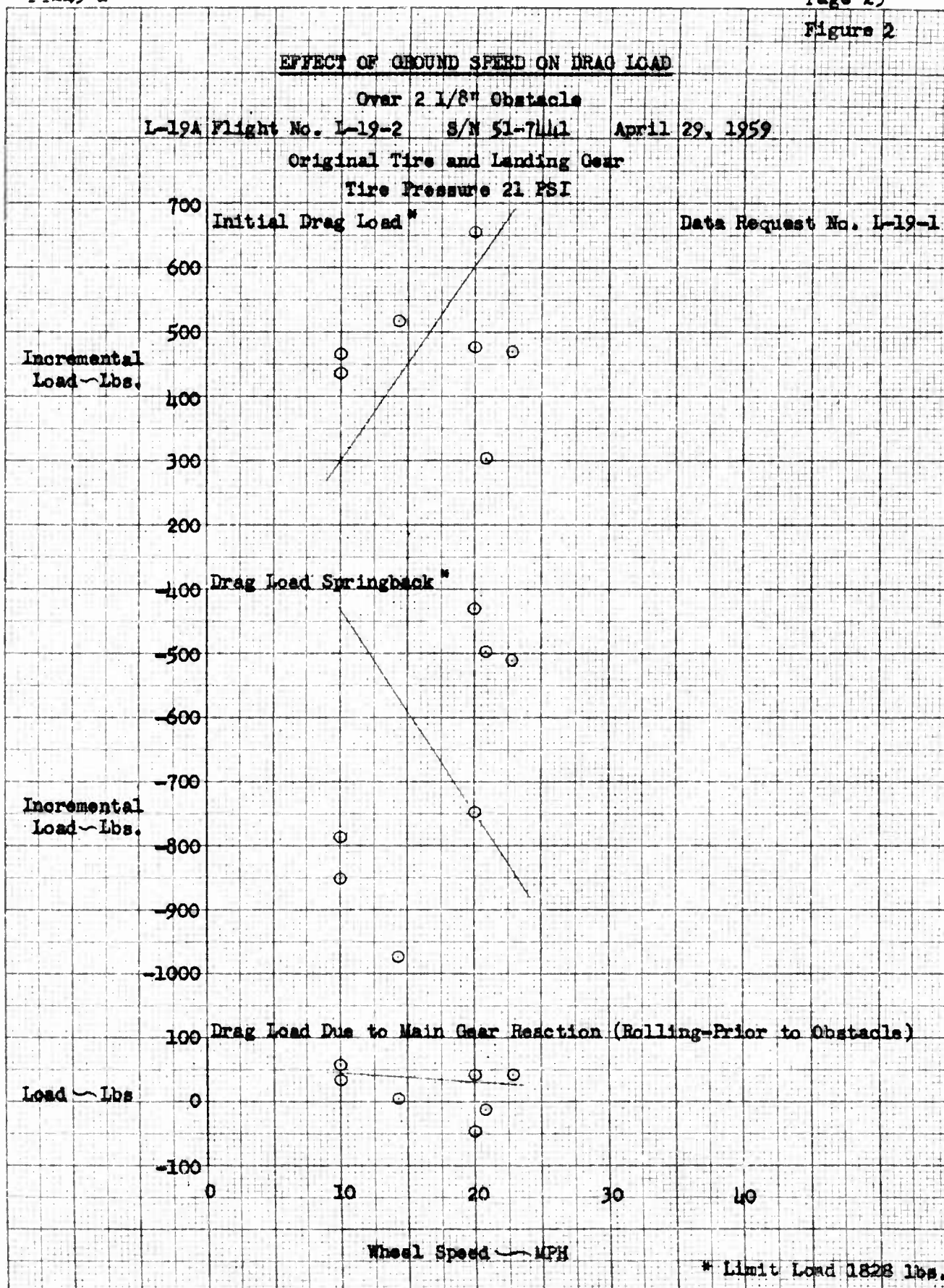
Tire Pressure 21 PSI

Data Request No. I-19-1



10 X 10 TO THE 1/2 INCH 359T-11
 KELFEL & ESSER CO. ALBANY, N.Y.

Figure 2



K&E 10 X 10 TO THE 1/2 INCH 359T-11
COPIES 9 ESSR CC
ALB/NENE

Figure 3

EFFECT OF GROUND SPEED ON AIRCRAFT ACCELERATIONS

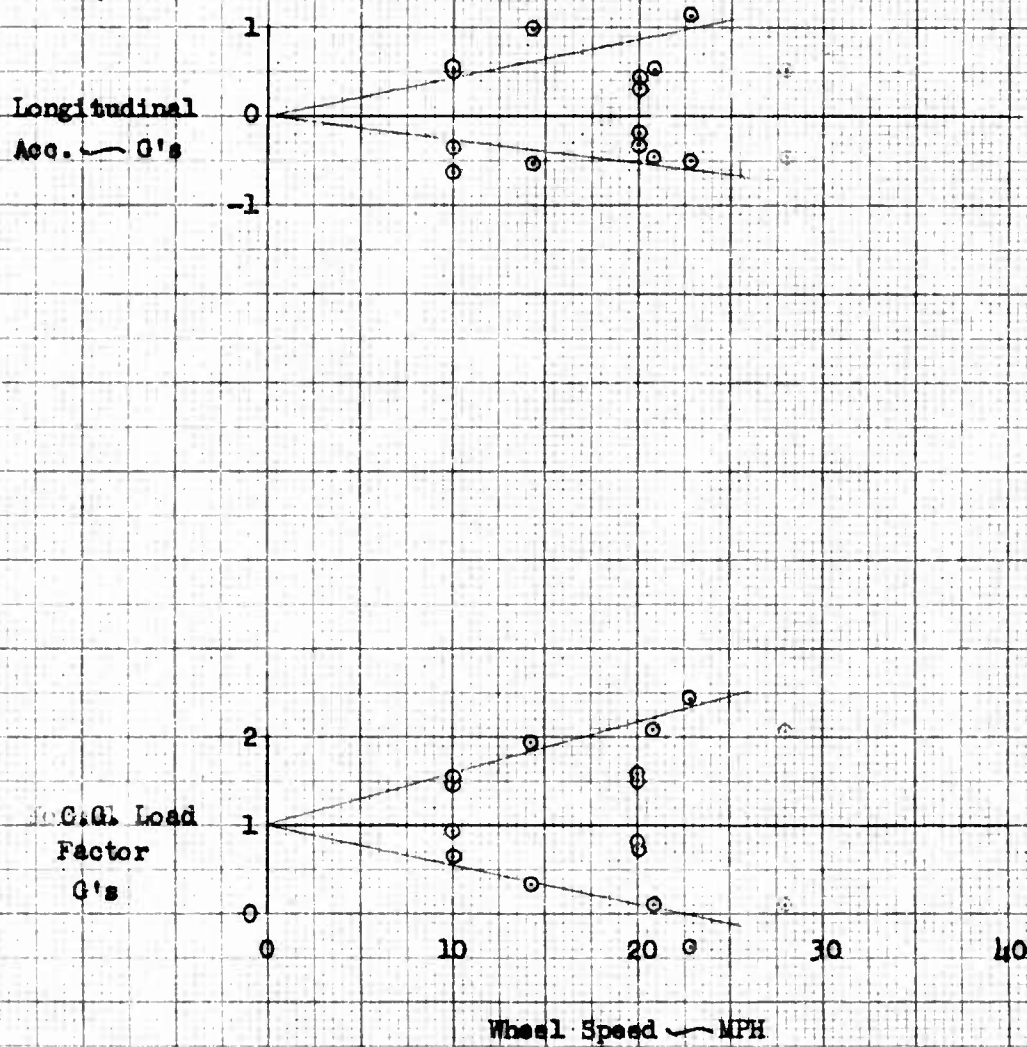
Over 2 1/8" Obstacle

L-19A Flight No. L-19-2 S/N 51-7441 April 29, 1959

Original Tire and Landing Gear

Tire Pressure 21 PSI

Data Request No. L-19-1



10 X 10 TO THE 1/2 INCH 359T-11
 GUFFEL & ESSER CO.
 ALBANY, N. Y.

Figure 4

EFFECT OF GROUND SPEED ON SIDE LOAD

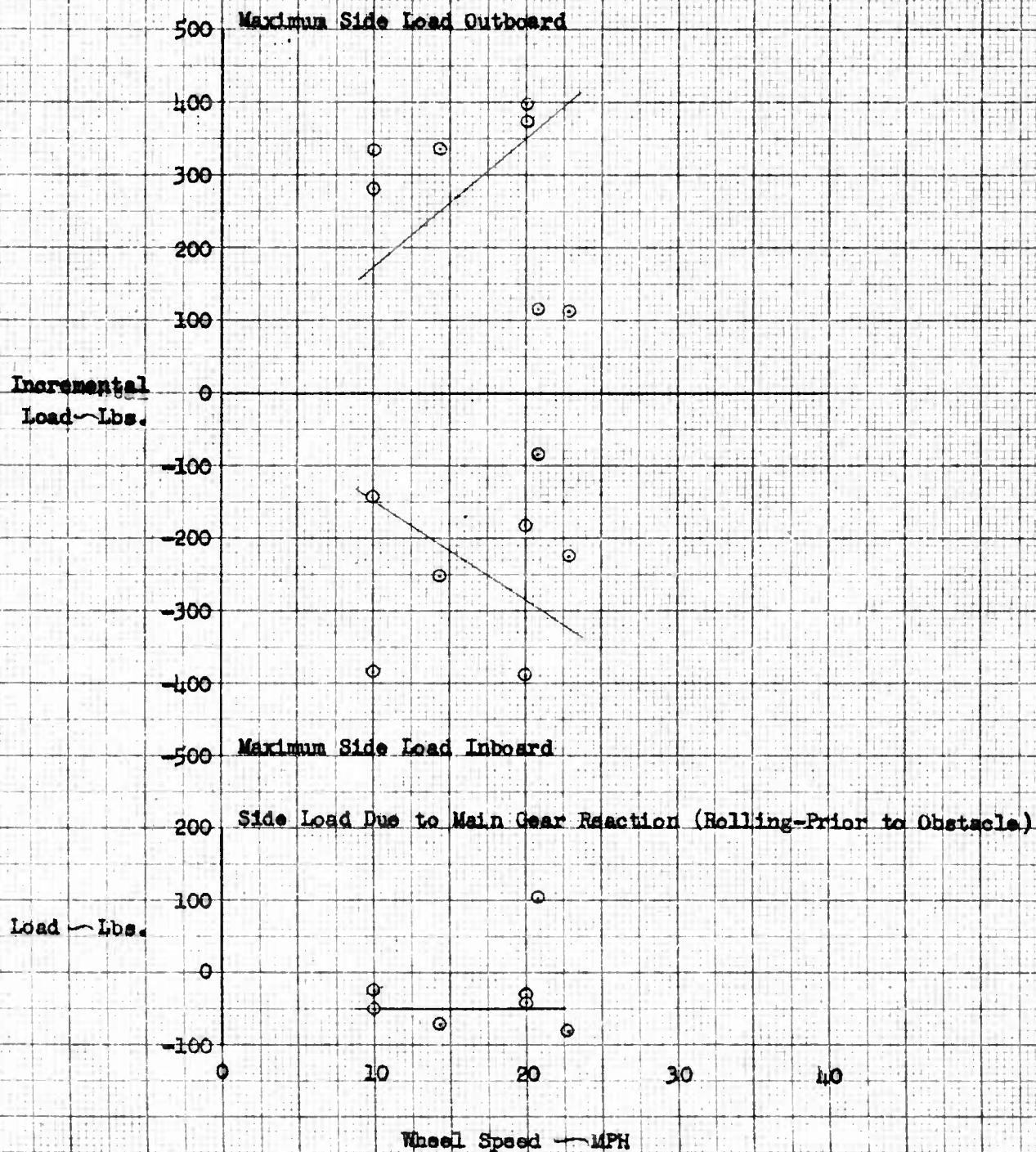
Over 2 1/8" Obstacle

L-19A Flight No. L-19-2 S/N 51-7441 April 29, 1959

Original Tire and Landing Gear

Tire Pressure 21 PSI

Data Request No. L-19-1



K&E 10 X 10 TO THE 1/2 INCH 359T-11
K&E 10 X 10 TO THE 1/2 INCH 359T-11
ALBANY, N.Y.

Figure 5

EFFECT OF GROUND SPEED ON TORSION (DRAG) LOAD

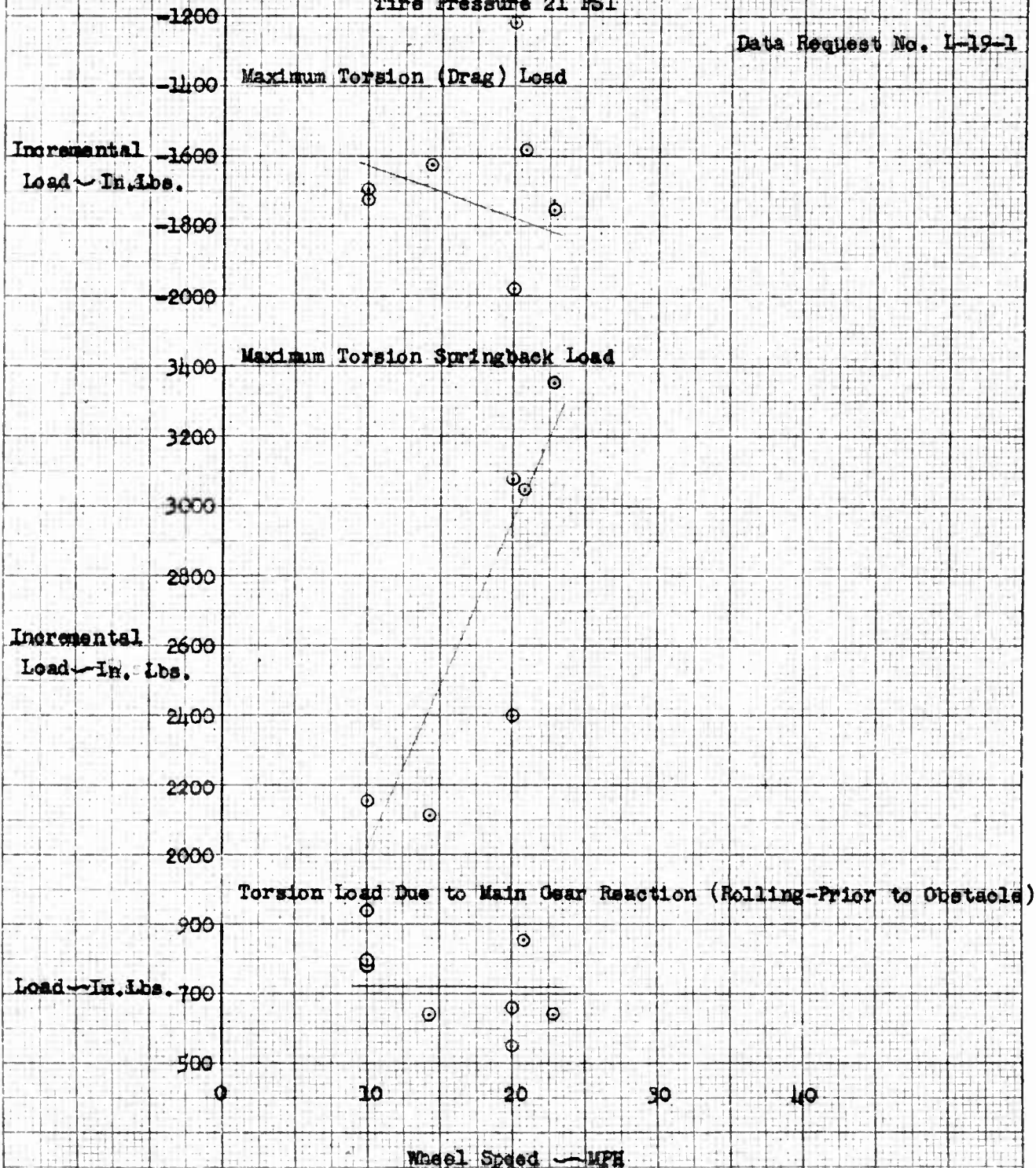
Over 2 1/8" Obstacle

L-19A Flight No. L-19-2 S/N 51-7441 April 29, 1959

Original Tire and Landing Gear

Tire Pressure 21 PSI

Data Request No. L-19-1



L-19A LANDING TESTS - ORIGINAL TIRE AND LANDING GEAR

Sinking Speed Vs. C.G. Load Factor, L. Gear Initial Drag and Vertical Loads

Flight No. L-19-1 S/N 51-7441 April 22, 1959

Tire Pressure 21 PSI

Data Request L-19-2

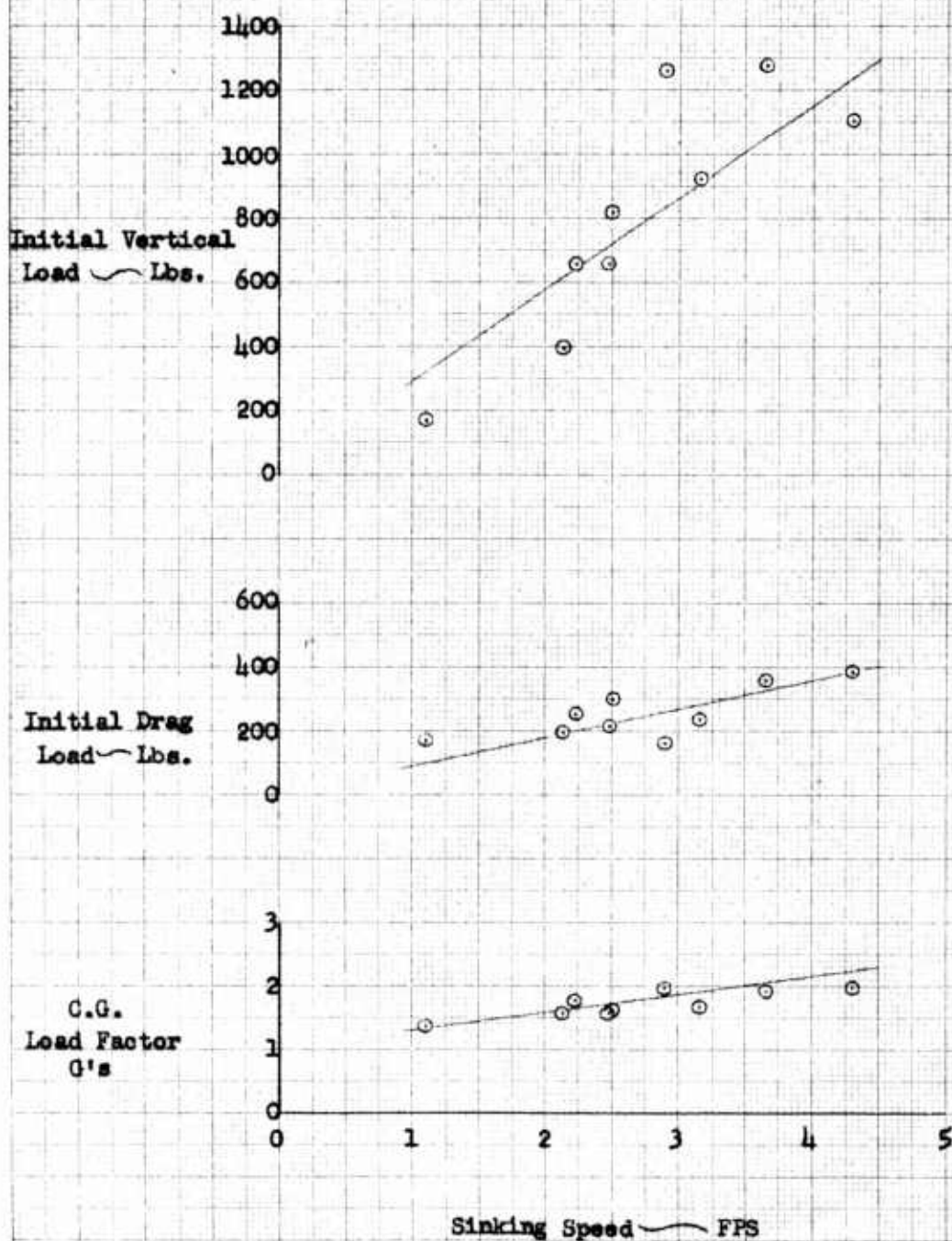


Figure 7

ORIGINAL TIRE AND GEAR LANDING LOAD TIME HISTORY

L-19A Flight No. 19-1

S/N 51-7441

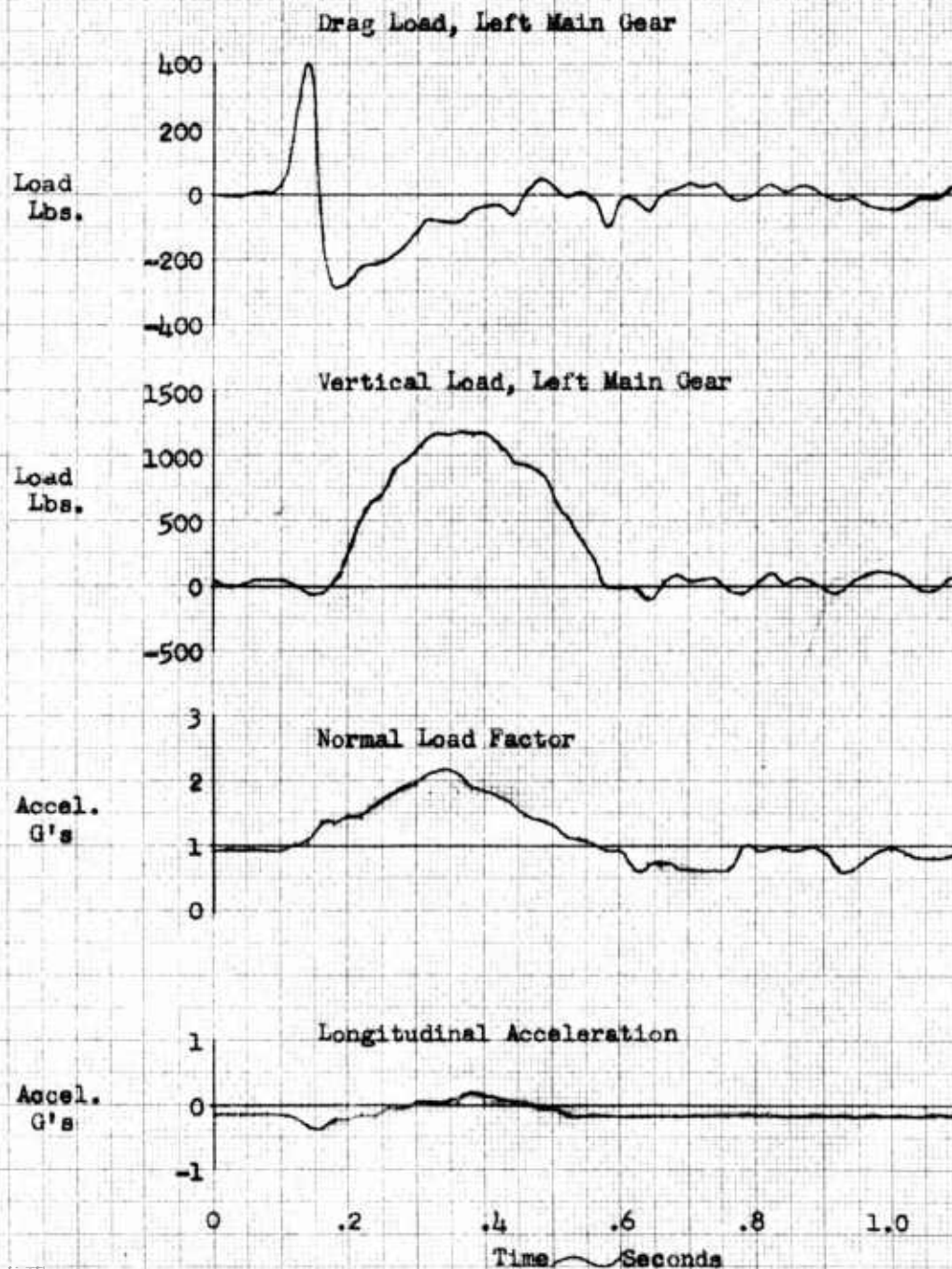
June 22, 1959

Sinking Speed 4.3 fps

FAT 57° F

Data Request No. L-19-2

Oscillograph Record No. 24301



LEB (FTE) 8-10-59

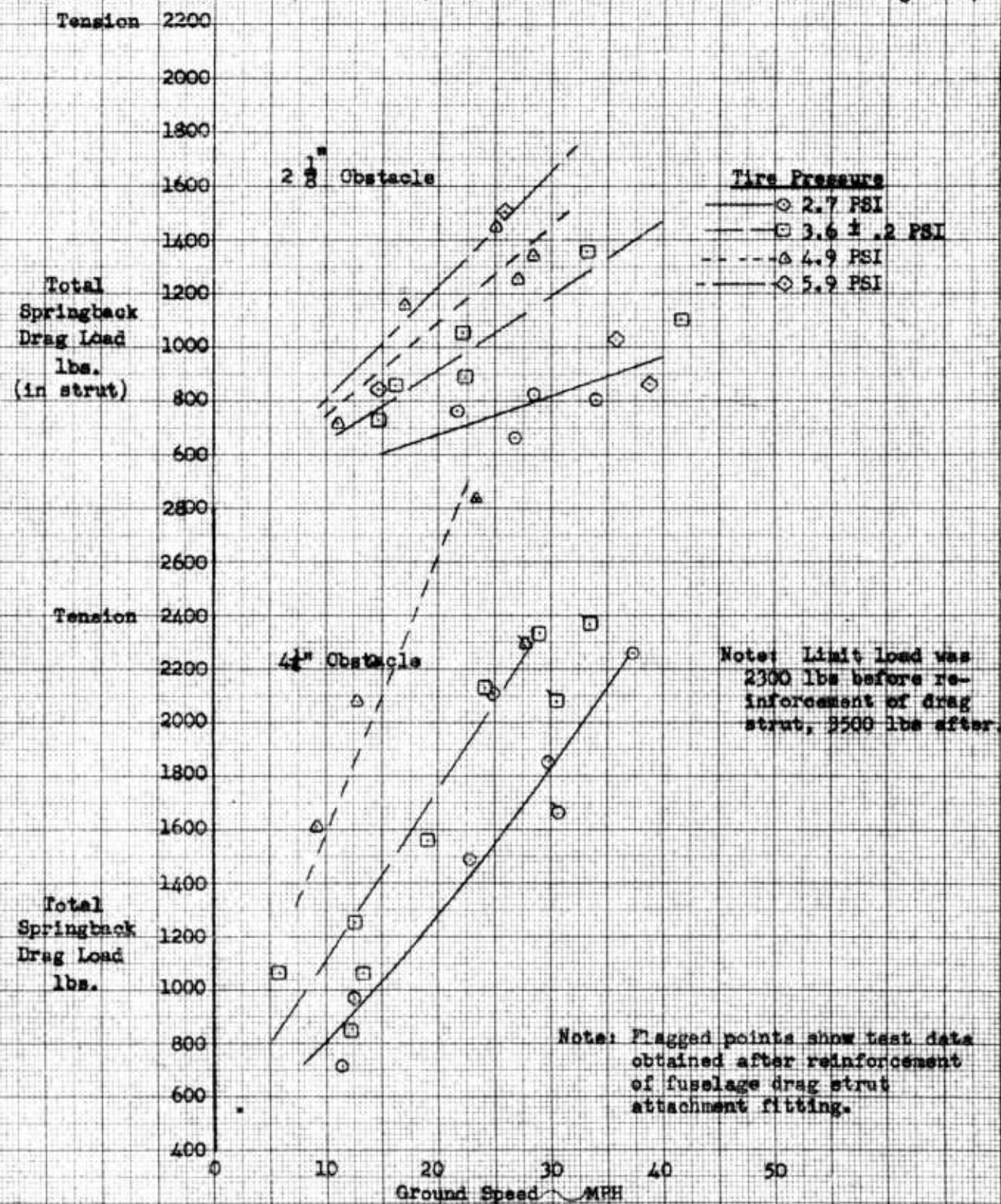
Figure 8

EFFECT OF OBSTACLE HEIGHT, GROUND SPEED AND TIRE PRESSURE ON SPRINGBACK DRAG LOADS

L-19A Ground Tests

S/N 51-7441

(M245B Landing Gear)

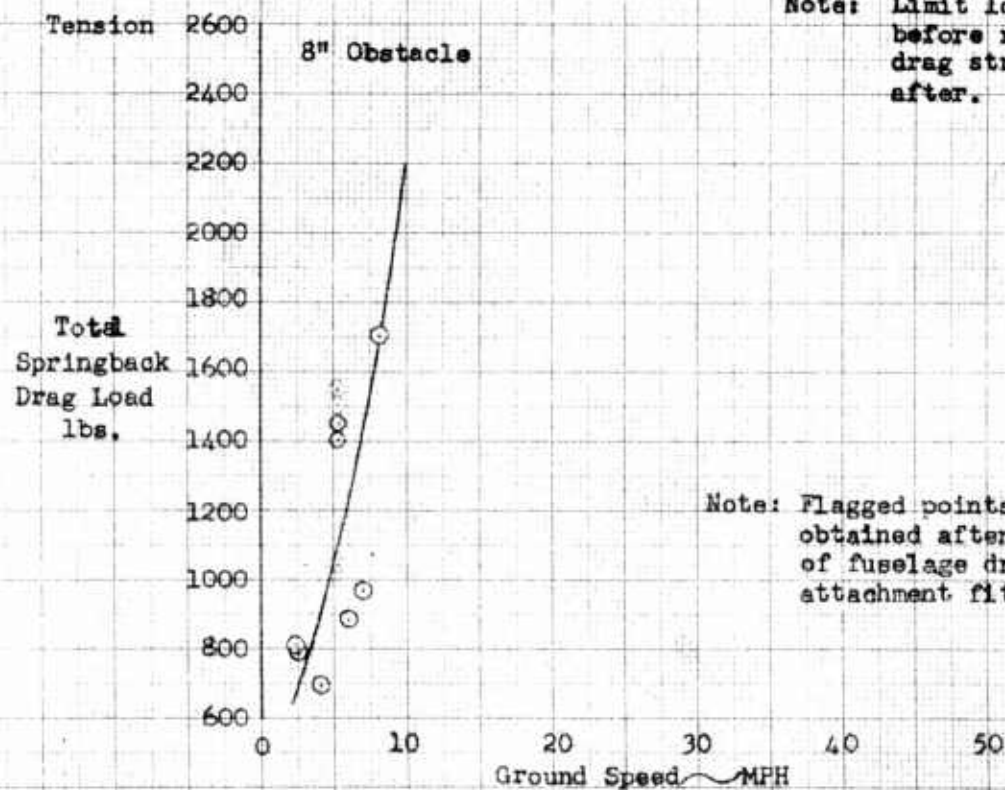
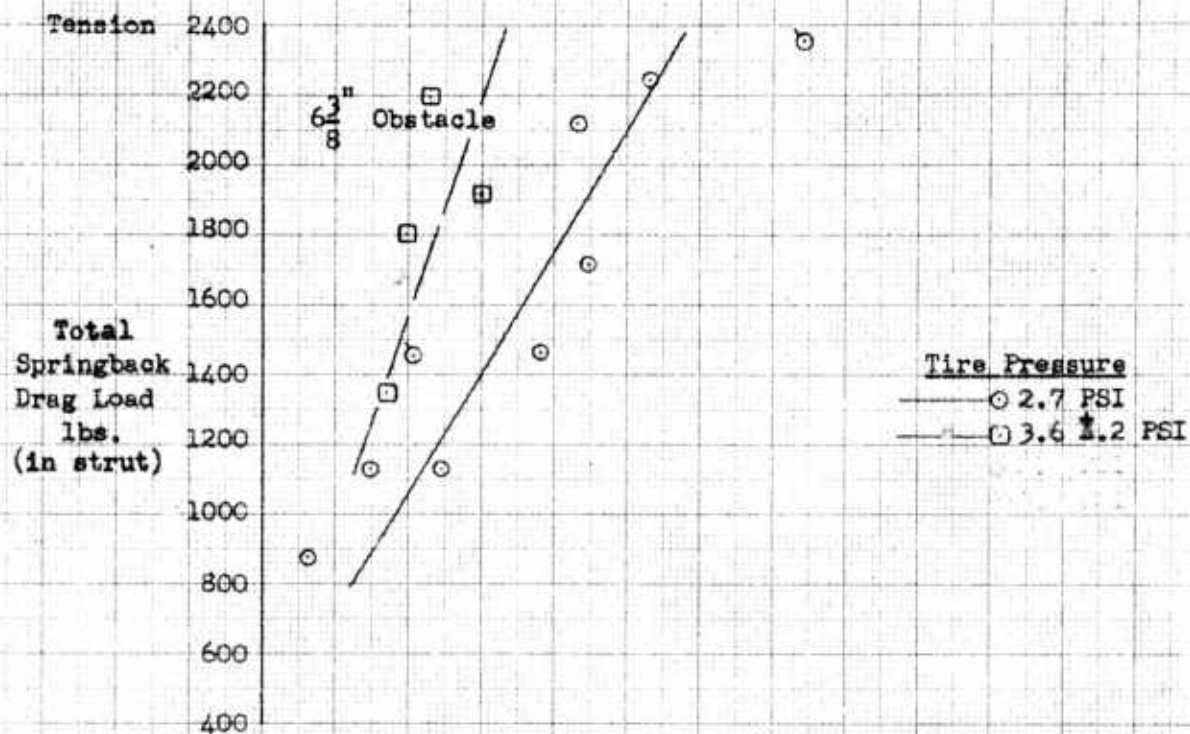


RHS & LEB 6-1-59 (FTE)

K·E 10 X 10 TO THE CM. 359T-14
KEUFFEL & ESSER CO. ALBANY, N.Y.

Figure 9

EFFECT OF OBSTACLE HEIGHT, GROUND SPEED AND TIRE PRESSURE ON SPRINGBACK DRAG LOADS
L-19A Ground Tests S/N 51-7441 (M245B Landing Gear)



Note: Limit load was 2300 lbs before reinforcement of drag strut, 3500 lbs after.

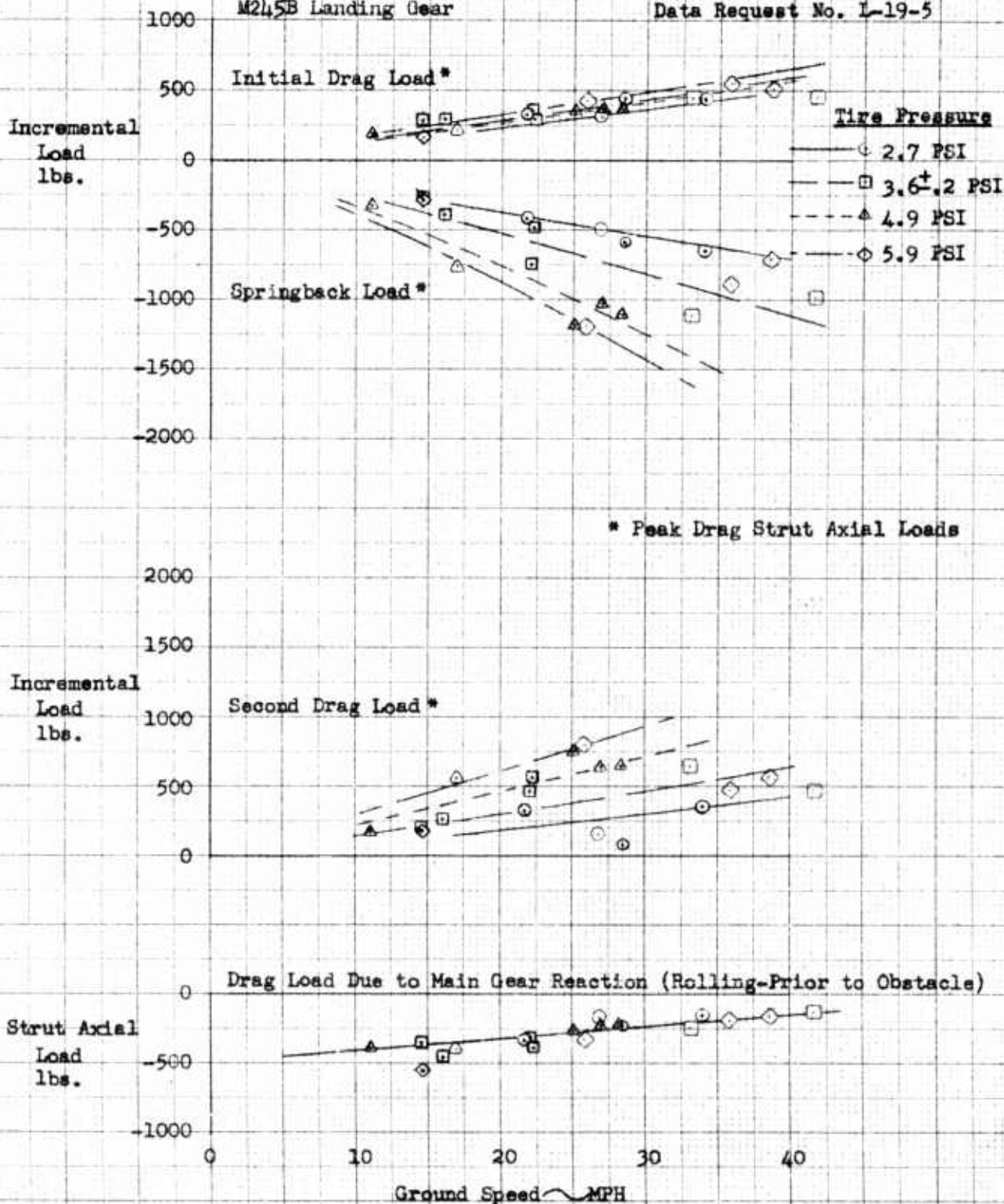
359T-14
 10 X 10 TO THE CM
 1/2" 10 LIFT & RESERVE
 1/2" 10 LIFT & RESERVE

Figure 10

**EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
DRAG STRUT AXIAL LOAD OVER 2 1/4 INCH OBSTACLE**

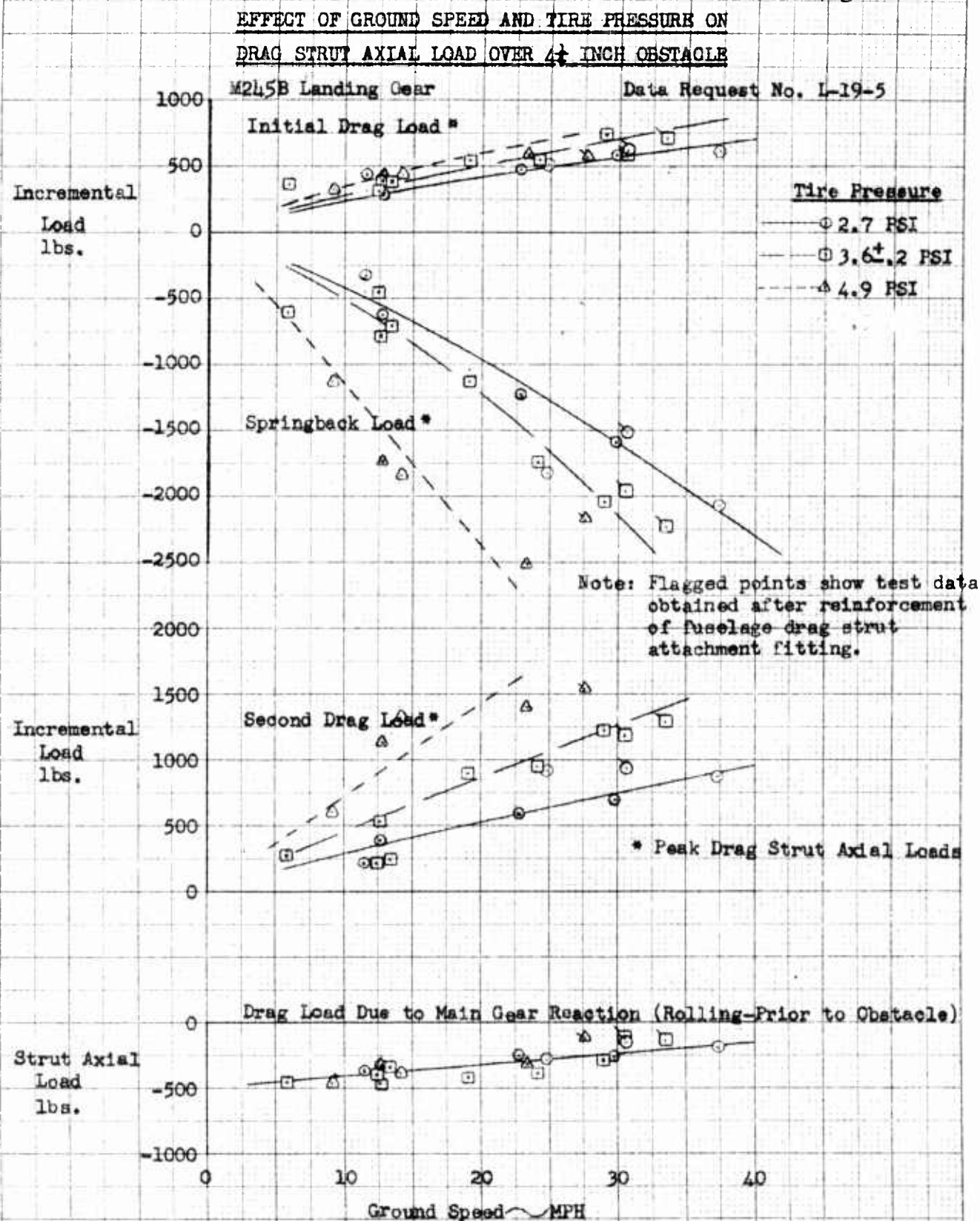
M245B Landing Gear

Data Request No. L-19-5



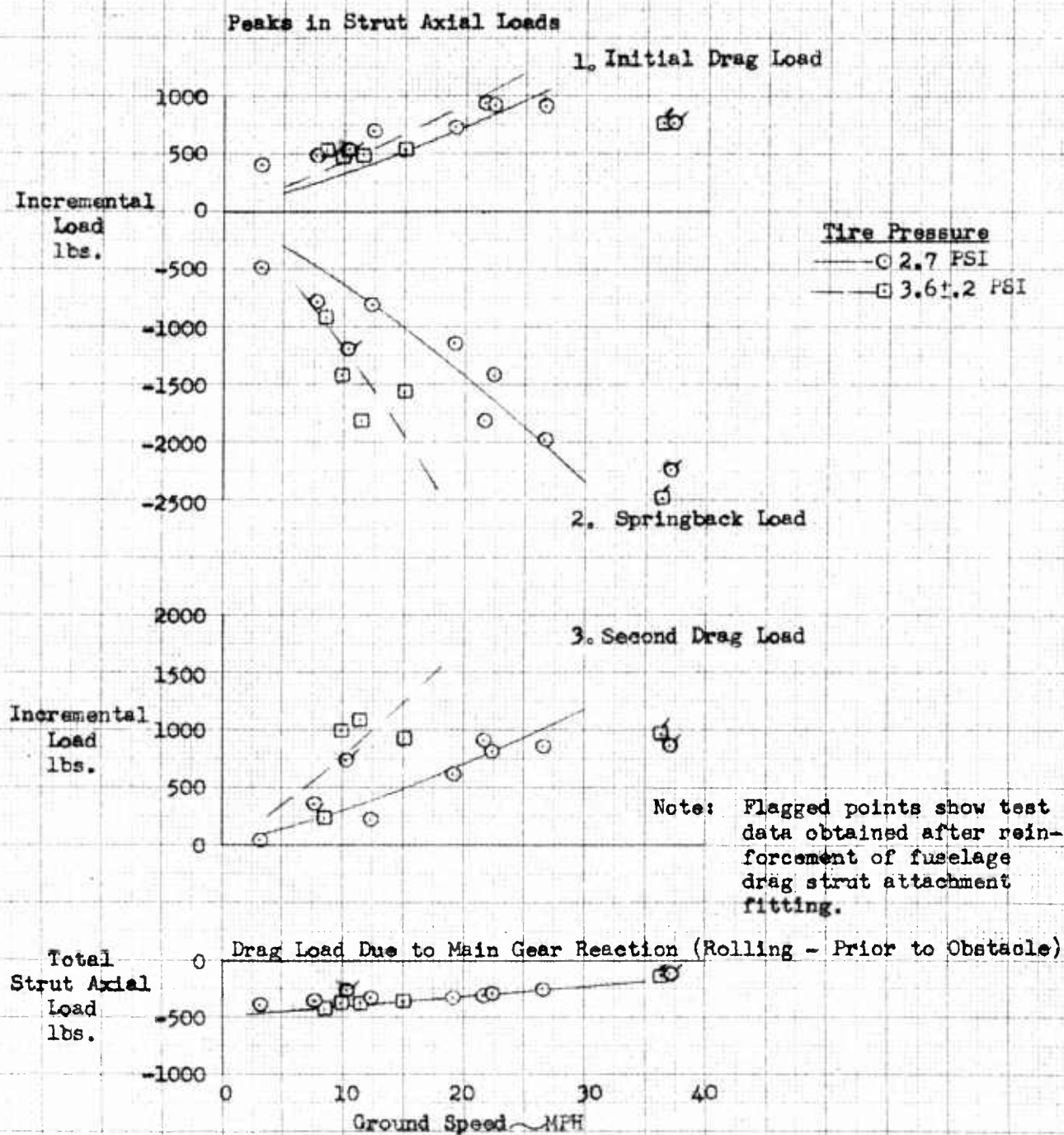
10 X 10 TO THE 1/2 INCH 359T 11
ALBANY, N.Y. 12205

Figure 11



**EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
DRAG STRUT AXIAL LOAD OVER 6 $\frac{1}{8}$ INCH OBSTACLE
M245B Landing Gear**

Data Request No. L-19-5



LEE (FTE) 6-1-59

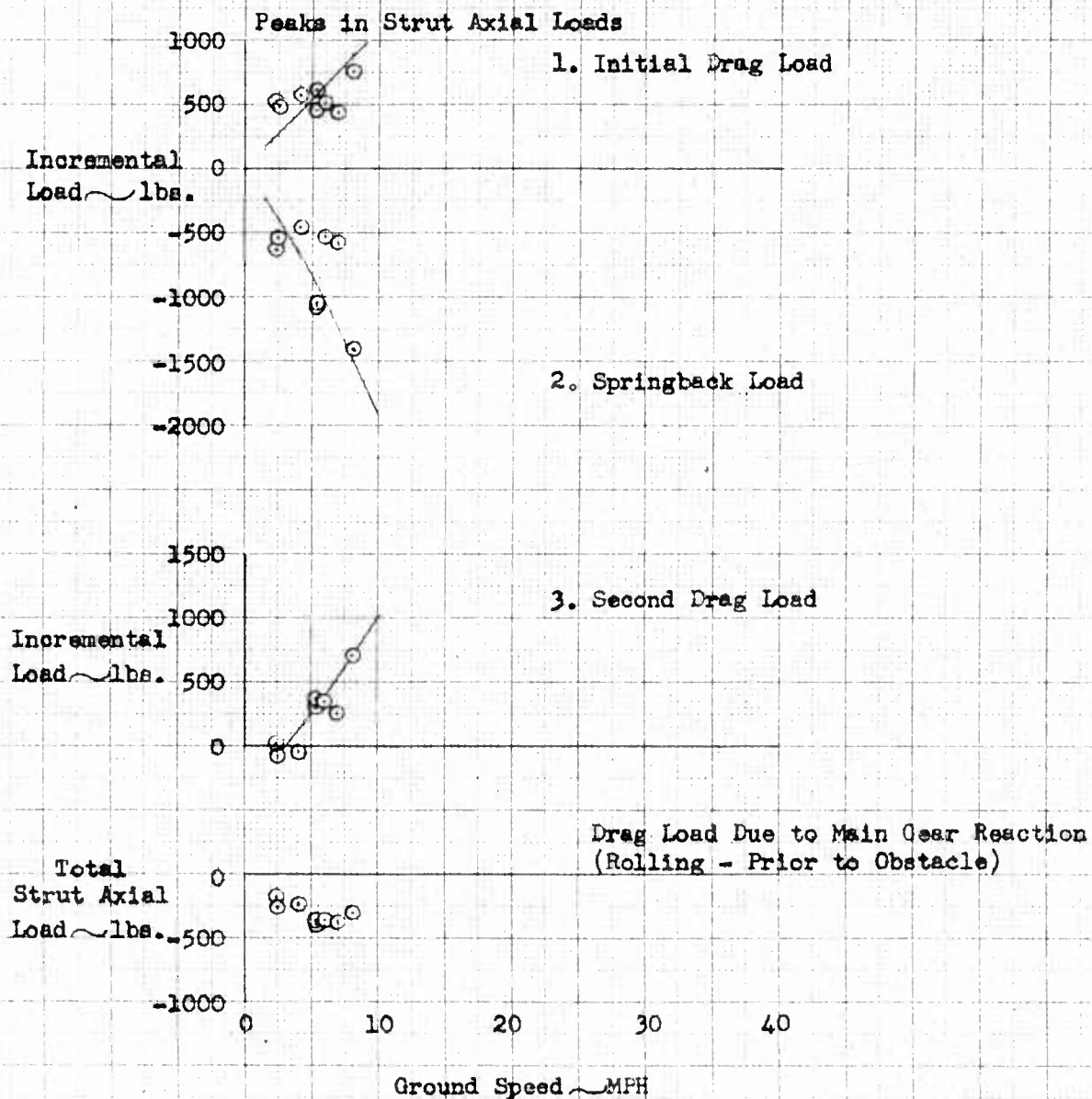
Figure 13

EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
DRAG STRUT AXIAL LOAD OVER 8 INCH OBSTACLE
 M245B Landing Gear

Data Request No. L-19-5

Tire Pressure

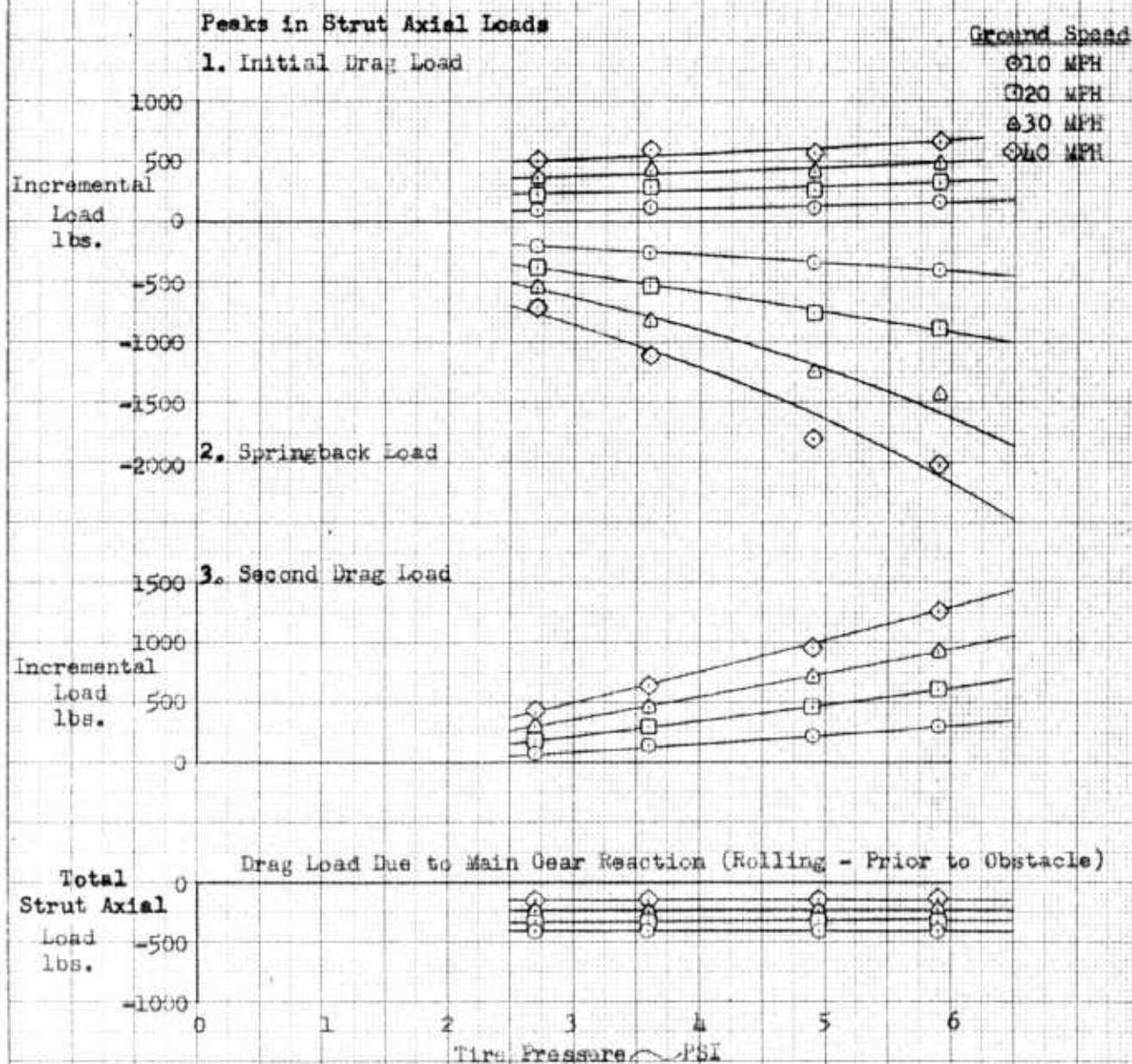
—○ 2.7 PSI



LEB (FTE) 6-5-59

INCREMENTAL DRAG STRUT AXIAL LOAD VS TIRE PRESSURE
AT VARIOUS GROUND SPEEDS OVER 2 1/2 INCH OBSTACLE
 M-245B Landing Gear On L-19A Airplane

Data Request No. L-19-5

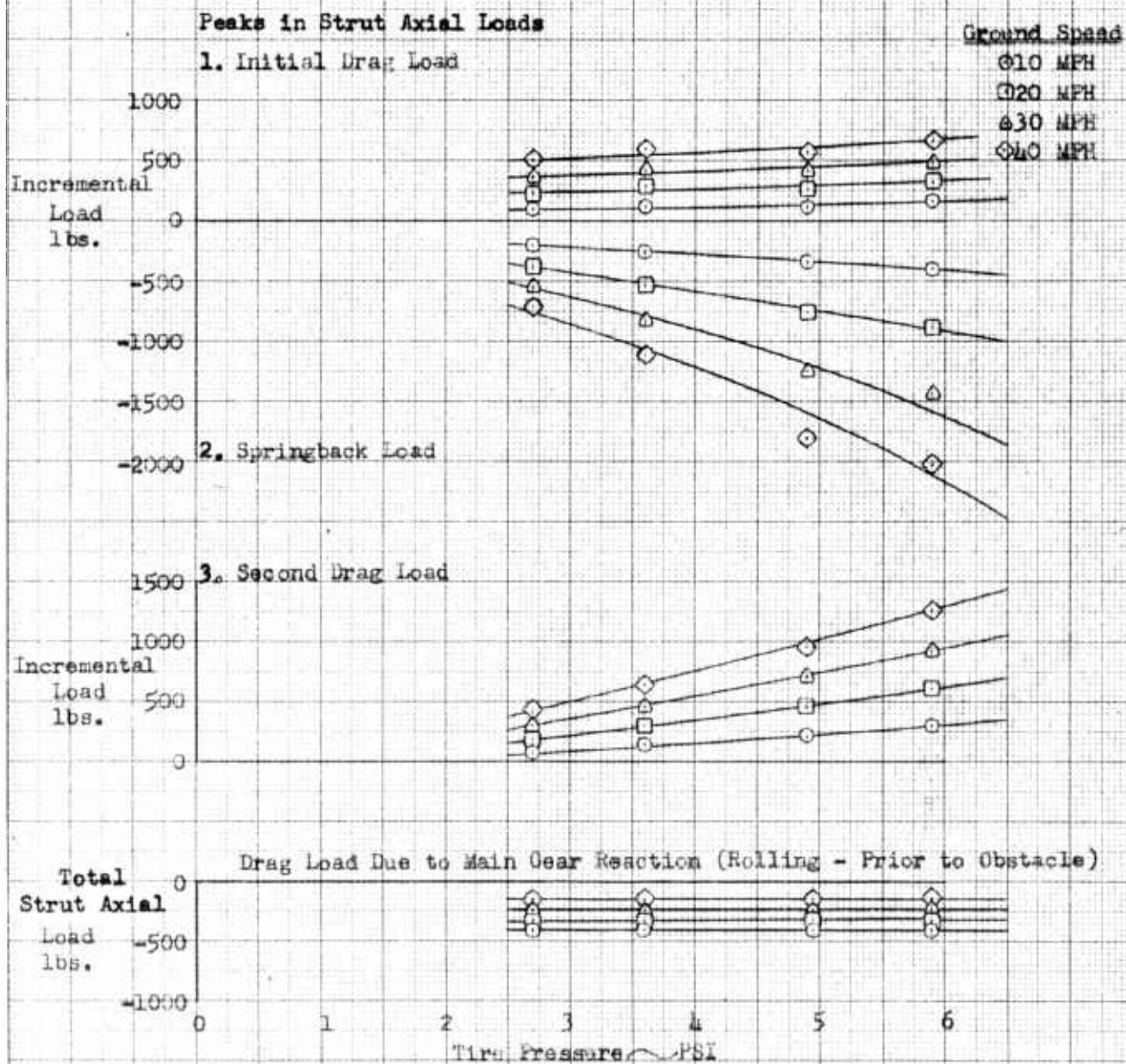


LES (FTE) 6-22-59

Figure 14

INCREMENTAL DRAG STRUT AXIAL LOAD VS. TIRE PRESSURE
AT VARIOUS GROUND SPEEDS OVER 2-INCH OBSTACLE
 M-245B Landing Gear On L-19A Airplane

Data Request No. L-19-5

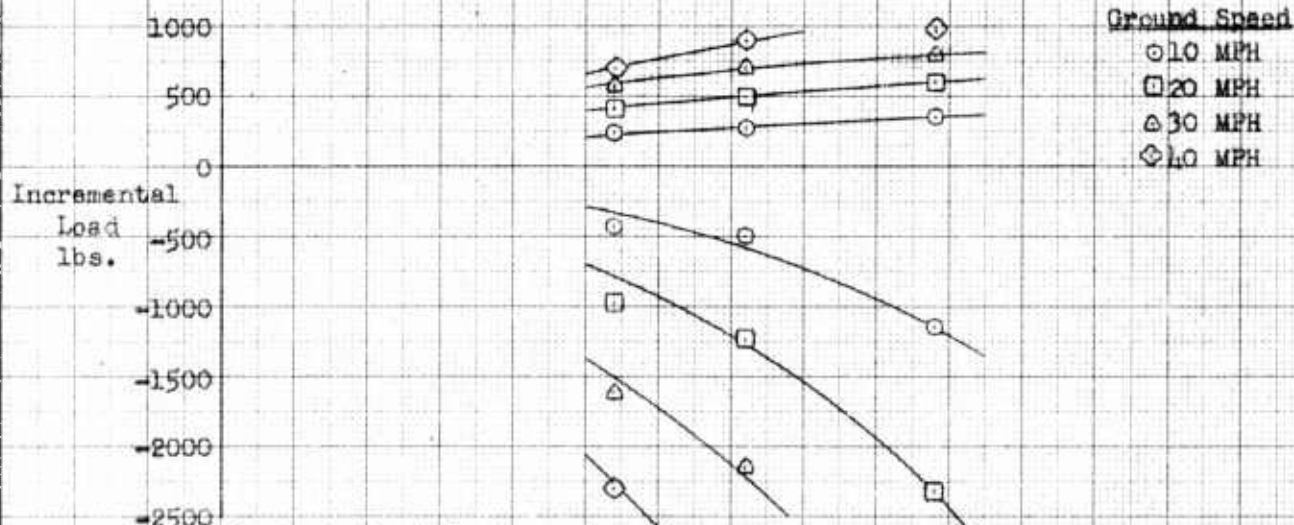
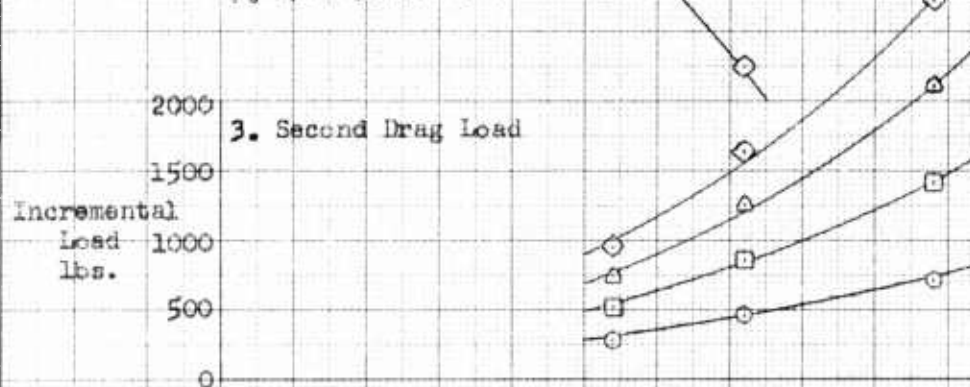
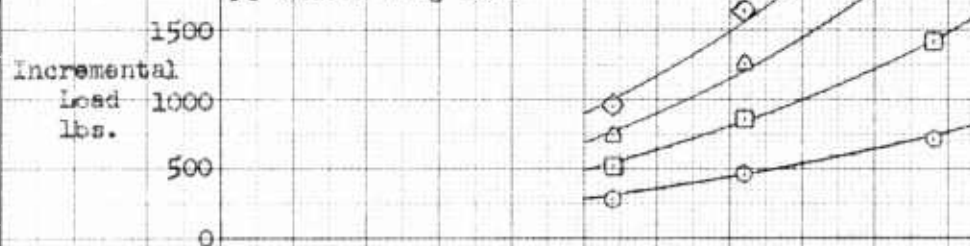


LES (FTE) 6-22-59

Figure 15

INCREMENTAL DRAG STRUT AXIAL LOAD VS TIRE PRESSURE
AT VARIOUS GROUND SPEEDS OVER $\frac{1}{4}$ INCH OBSTACLE
M-245B Landing Gear On L-19A Airplane

Data Request No. L-19-5

Peaks in Strut Axial Loads**1. Initial Drag Load****2. Springback Load****3. Second Drag Load**

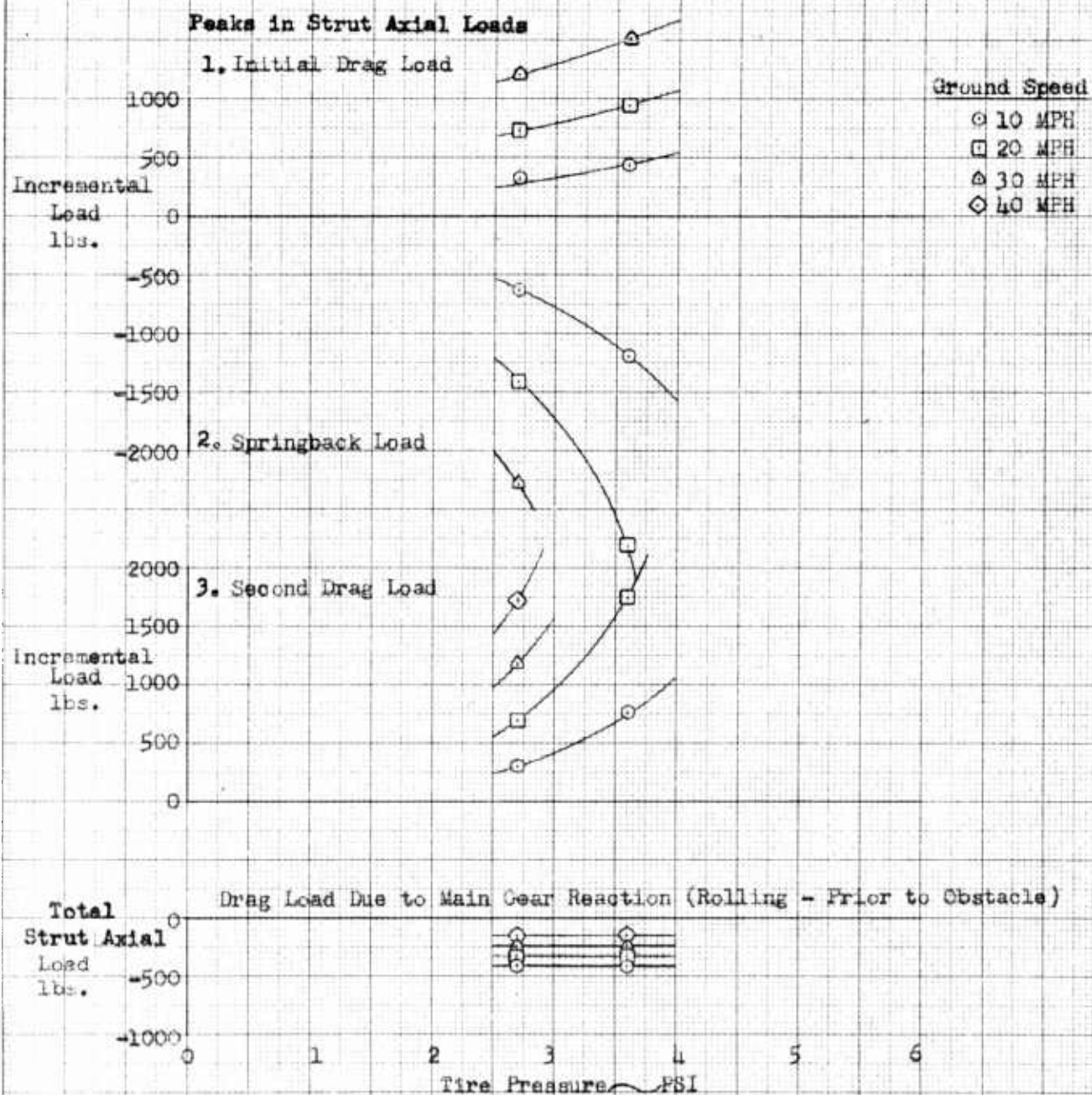
LEB (FTE) 6-22-59

10X10 TO THE CM 359T-14
 KEUFFEL & ESSER CO. ALBANY, N. Y.
 X-2

Figure 15

**INCREMENTAL DRAG STRUT AXIAL LOAD VS TIRE PRESSURE
AT VARIOUS GROUND SPEEDS OVER 6 3/4 INCH OBSTACLE
M-245B Landing Gear On L-19A Airplane**

Data Request No. L-19-5



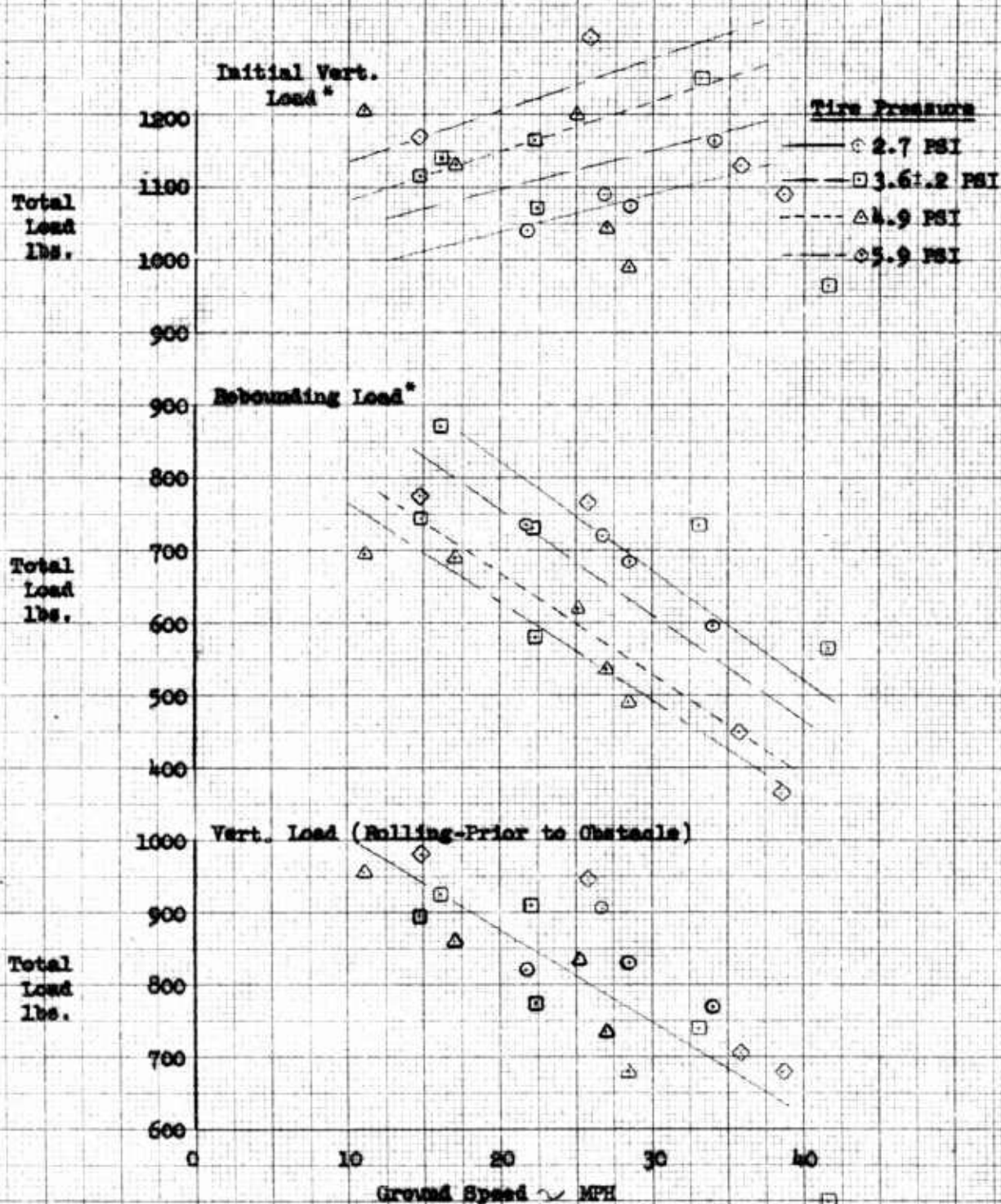
LEB (FTB) 6-22-59

Figure 17

**EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
VERTICAL LINK AXIAL LOAD OVER $2\frac{1}{2}$ INCH OBSTACLE**

M-245B Landing Gear

Data Request No. L-19-5



LCS & LRS (FTE) 6-4-59

* Limit Load is 3600 lbs.

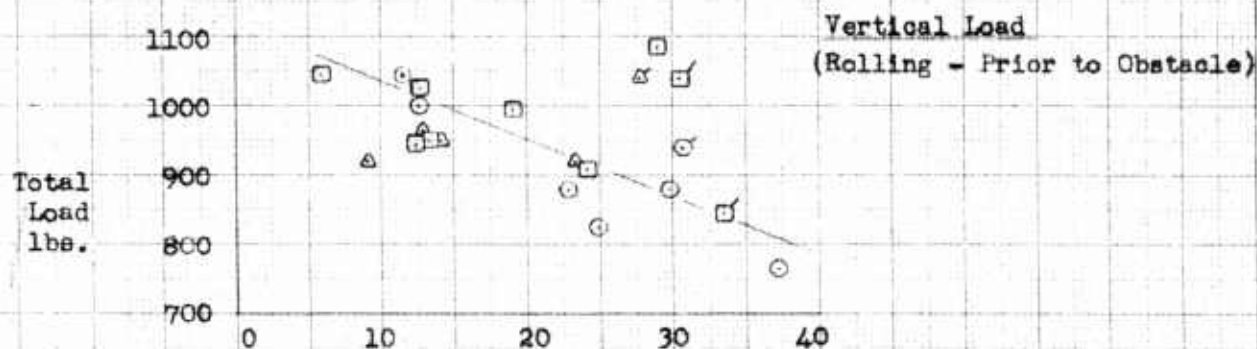
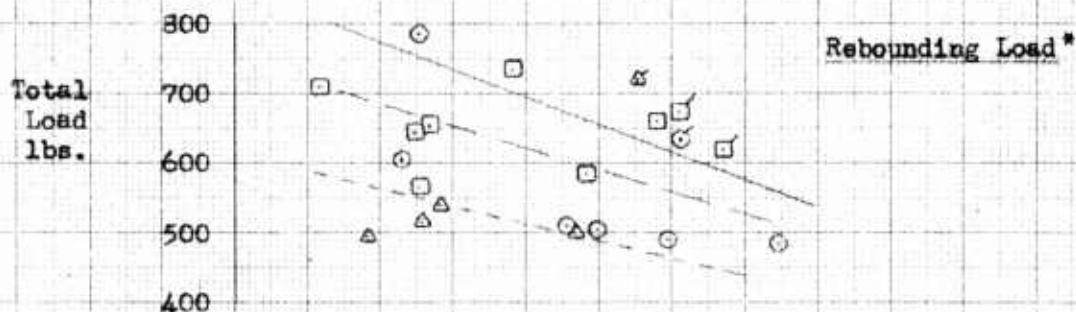
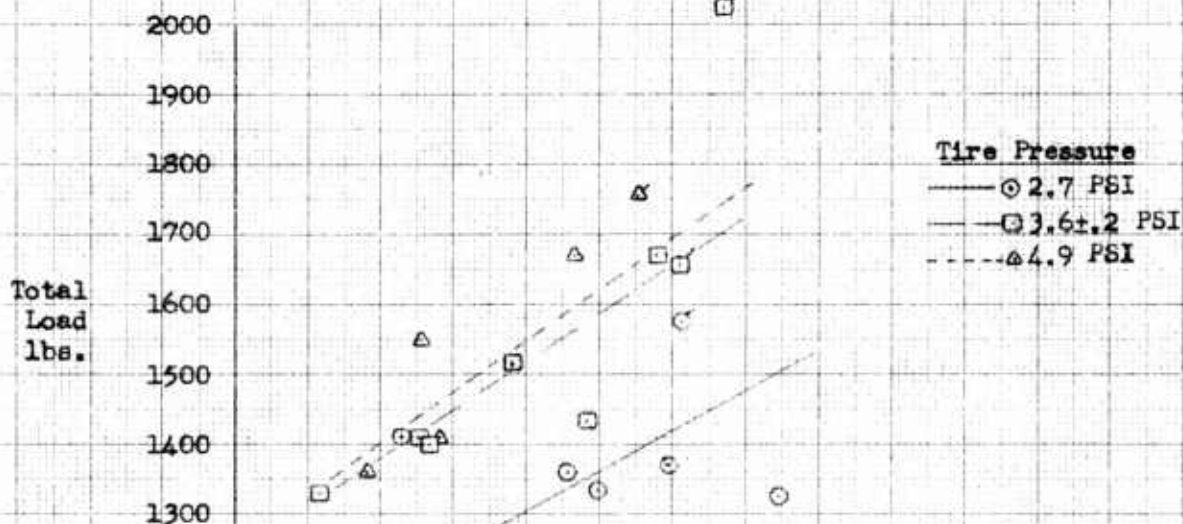
10 X 10 TO THE 1/2 INCH 3597 11
 10 X 10 TO THE 1/2 INCH 3597 11
 10 X 10 TO THE 1/2 INCH 3597 11

EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
VERTICAL LINK AXIAL LOAD OVER 4 1/4 INCH OBSTACLE

M245B Landing Gear

Data Request No. L-19-5

Initial Vertical Load*



Ground Speed ~ MPH

* Limit Load is 3600 lbs.

10 X 10 TO THE CM 359T-14
KEIFFEL & FESER CO. PART 1, 2, 3
ALBANY, N.Y.

EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
VERTICAL LINK AXIAL LOAD OVER $6\frac{1}{8}$ INCH OBSTACLE

M-245B Landing Gear

Data Request No. L-19-5

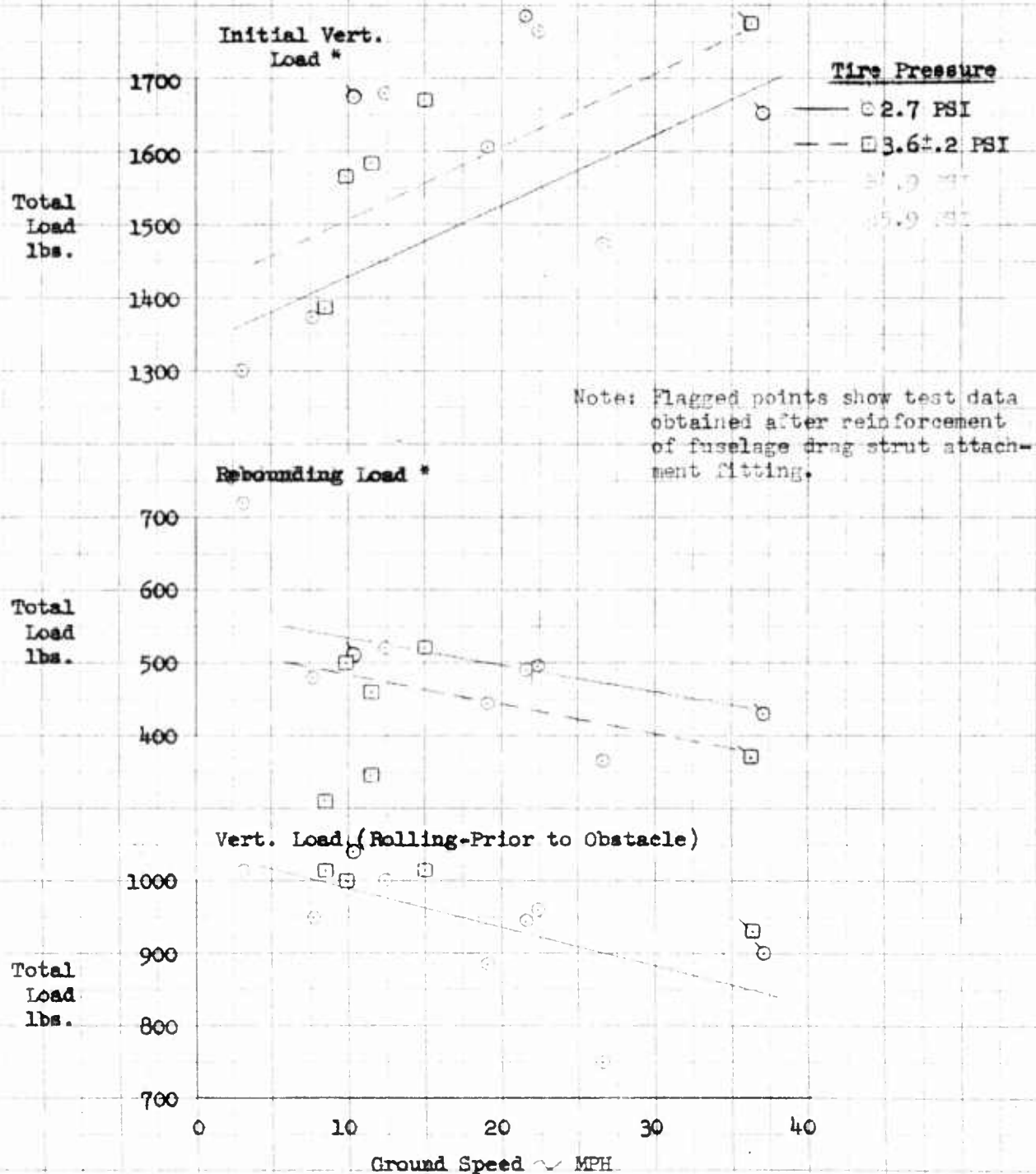
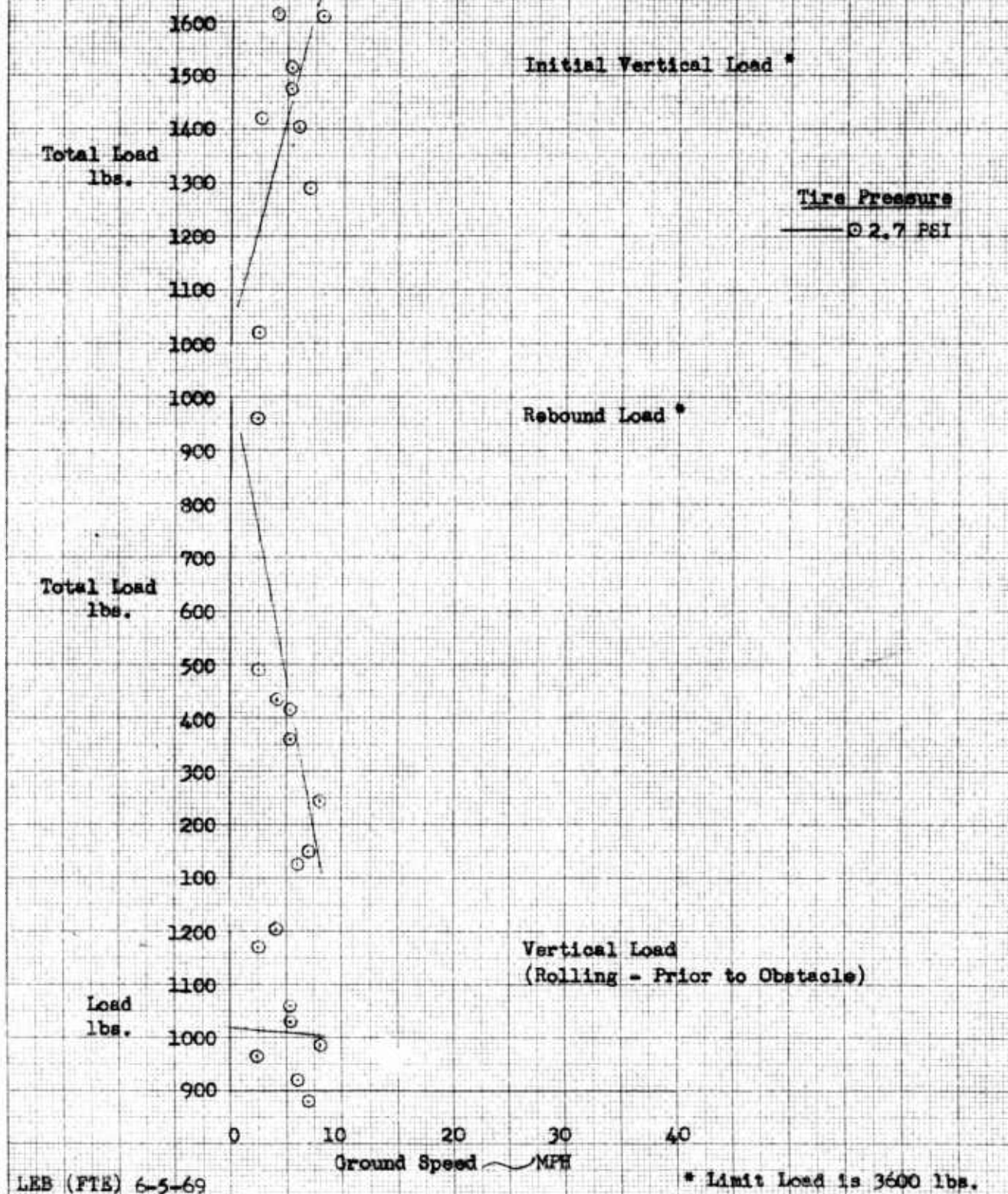


Figure 20

EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
VERTICAL LINK AXIAL LOAD OVER 3 INCH OBSTACLE
M245B Landing Gear

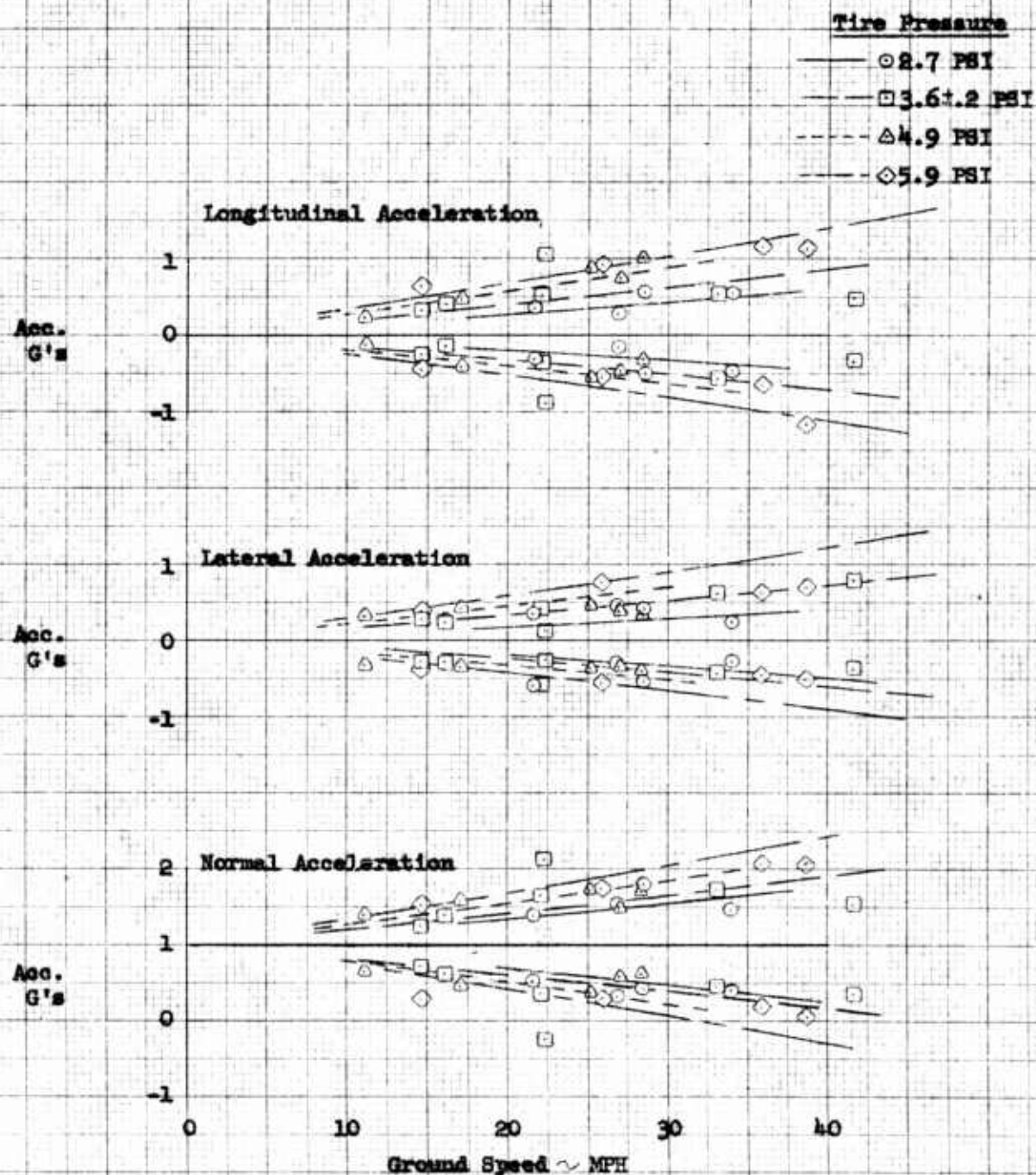
Data Request No. L-19-5



**EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
AIRCRAFT ACCELERATIONS OVER 2½ INCH OBSTACLE**

M245B Landing Gear

Data Request No. L-19-5



LEB (FTE) 6-4-59

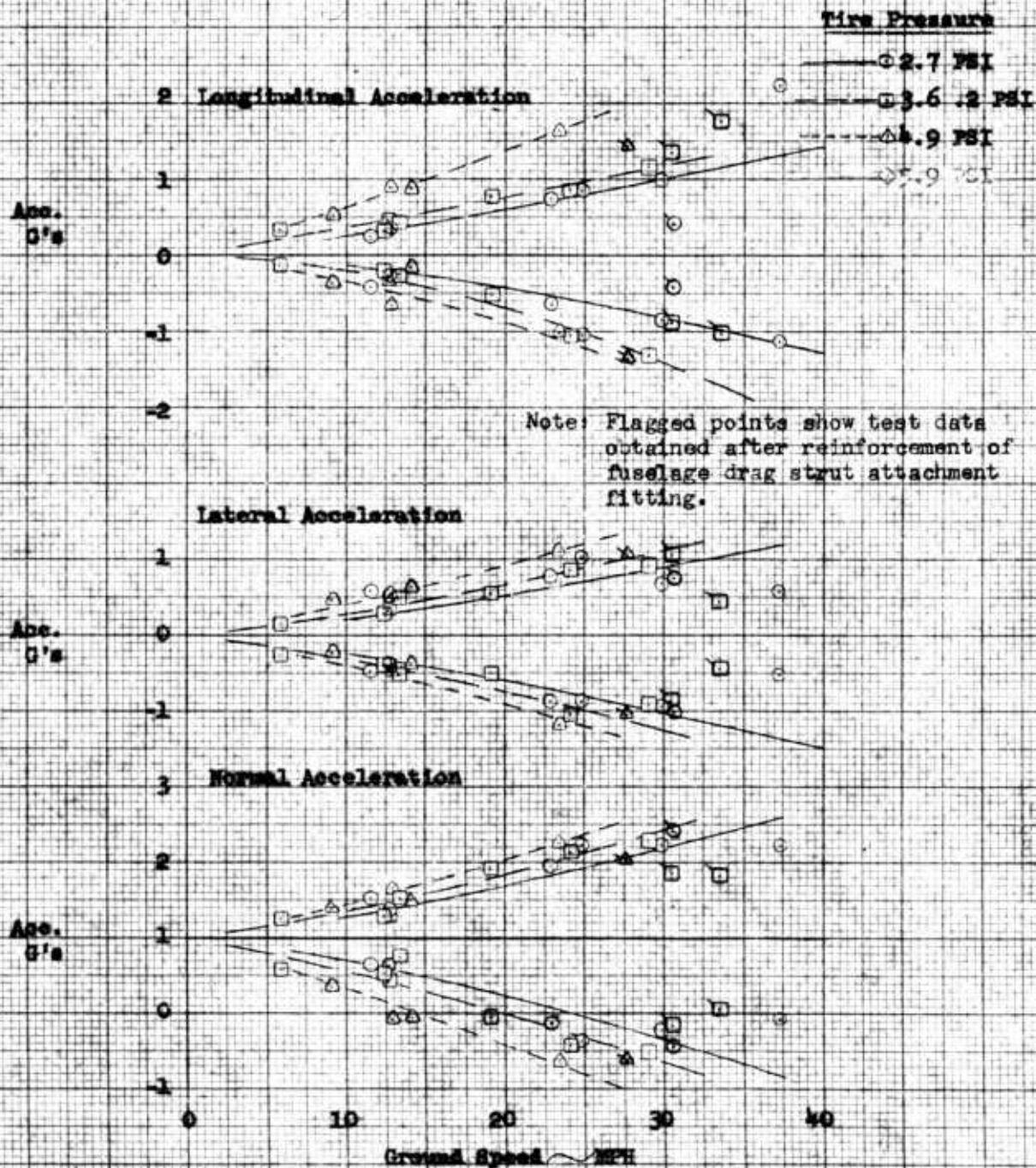
359-11
10410 TO THE 2 INCH
KEUFEL & ESSER CO.
MADE IN U.S.A.

Figure 22

EFFECT OF GROUND SPEED AND TIRE PRESSURE ON AIRCRAFT ACCELERATIONS OVER 4" HIGH OBSTACLE

M2458 Landing Gear

Data Request No. 1-19-5



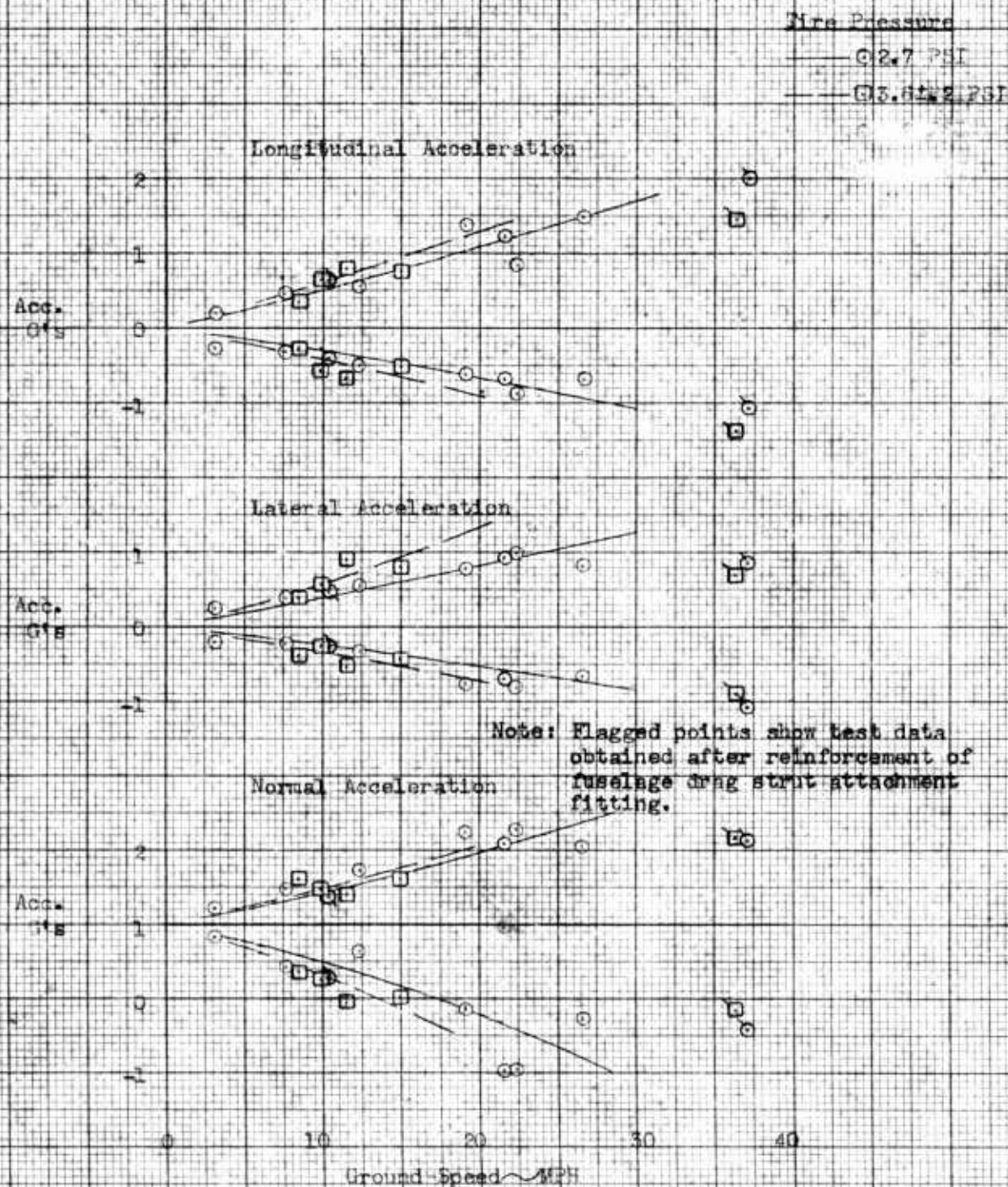
RMA (PRR) 6-4-59

Figure 23

EFFECT OF GROUND SPEED AND TIRE PRESSURE ON AIRCRAFT ACCELERATIONS OVER 6 $\frac{1}{2}$ INCH OBSTACLE

M245B Landing Gear

Data Request No. L-78-8



LCS & LRP (ITE) 8-4-59

Figure 24

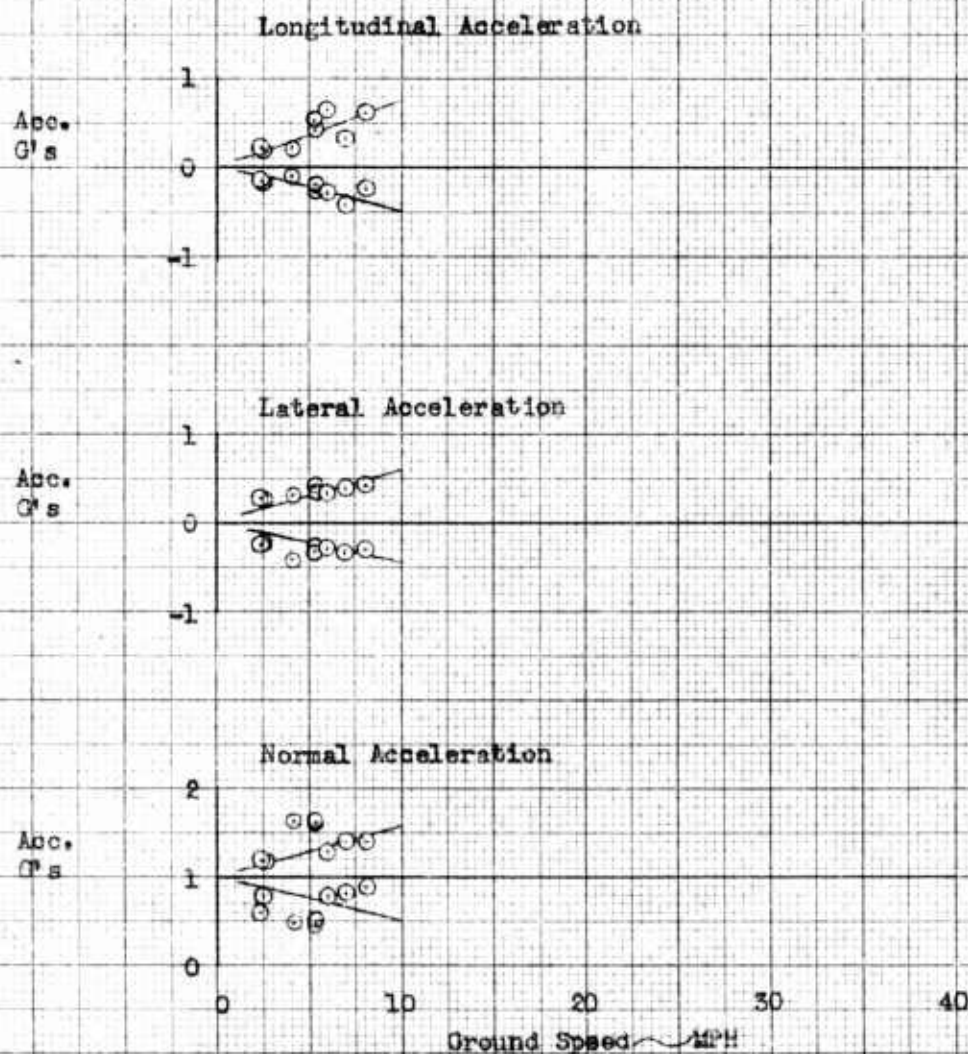
EFFECT OF GROUND SPEED AND TIRE PRESSURE ON
AIRCRAFT ACCELERATIONS OVER 9 INCH OBSTACLE

M245B Landing Gear

Data Request No. L-19-5

Tire Pressure

○ 2.7 PSI



LEB (PTE) B-5-59

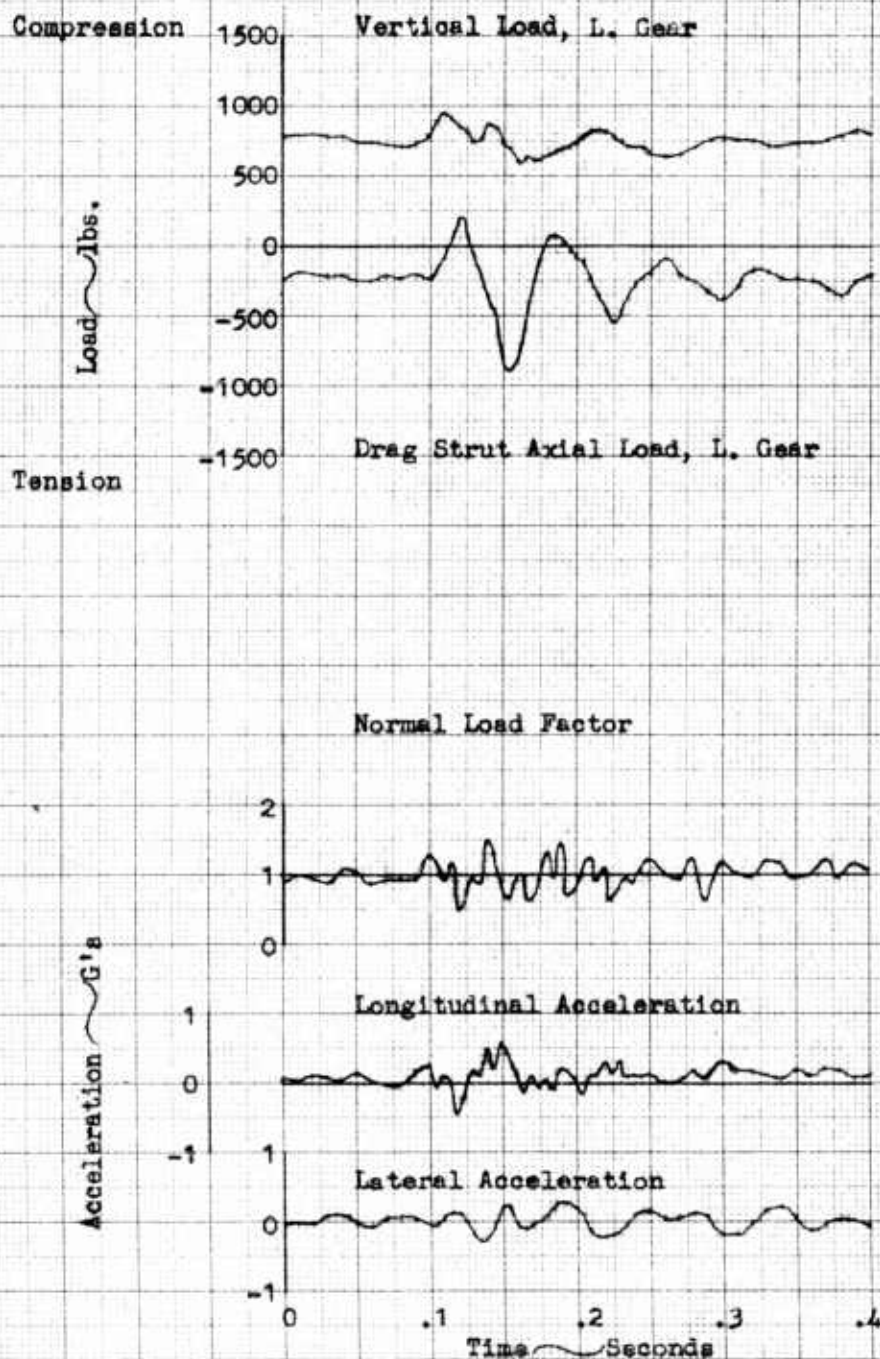
Figure 25

TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

Obstacle Height $2 \frac{1}{8}"$
Record No. 24597

M245B Landing Gear
Tire Pressure 2.7 PSI

Wheel Speed 34.0 MPH
May 27, 1959
Data Req. No. L19-5



TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

M245B Landing Gear
 Obstacle Height 2 1/8" Tire Pressure 3.6 ± .2 PSI Wheel Speed 33.1 MPH
 Record No. 24722 June 5, 1959
 Data Req. No. L19-5

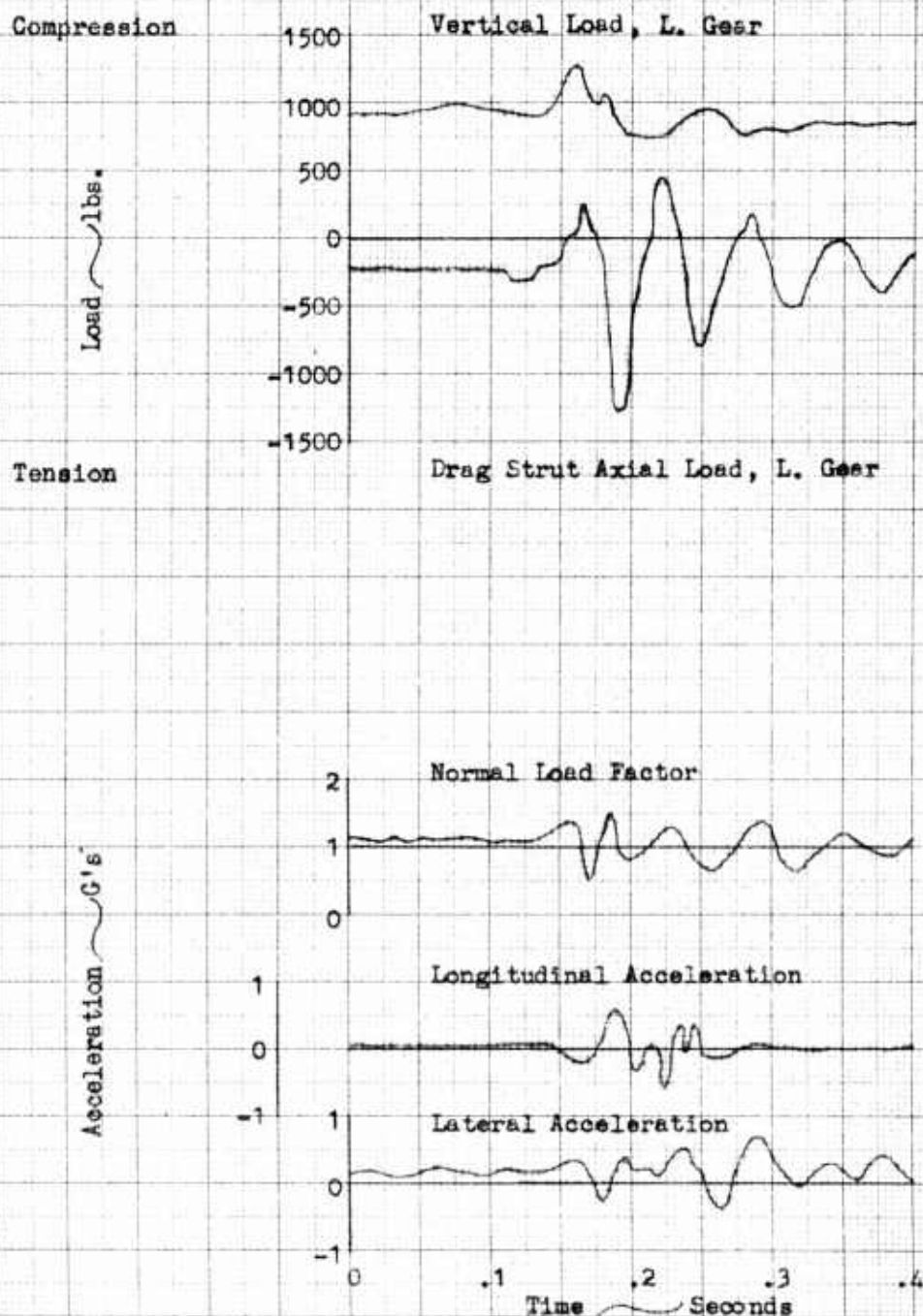


Figure 27

TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

Obstacle Height 2 1/8"
Record No. 24543

M245B Landing Gear
Tire Pressure 4.9 PSI

Wheel Speed 25.1 MPH
May 25, 1959
Data Rec. No. L19-5

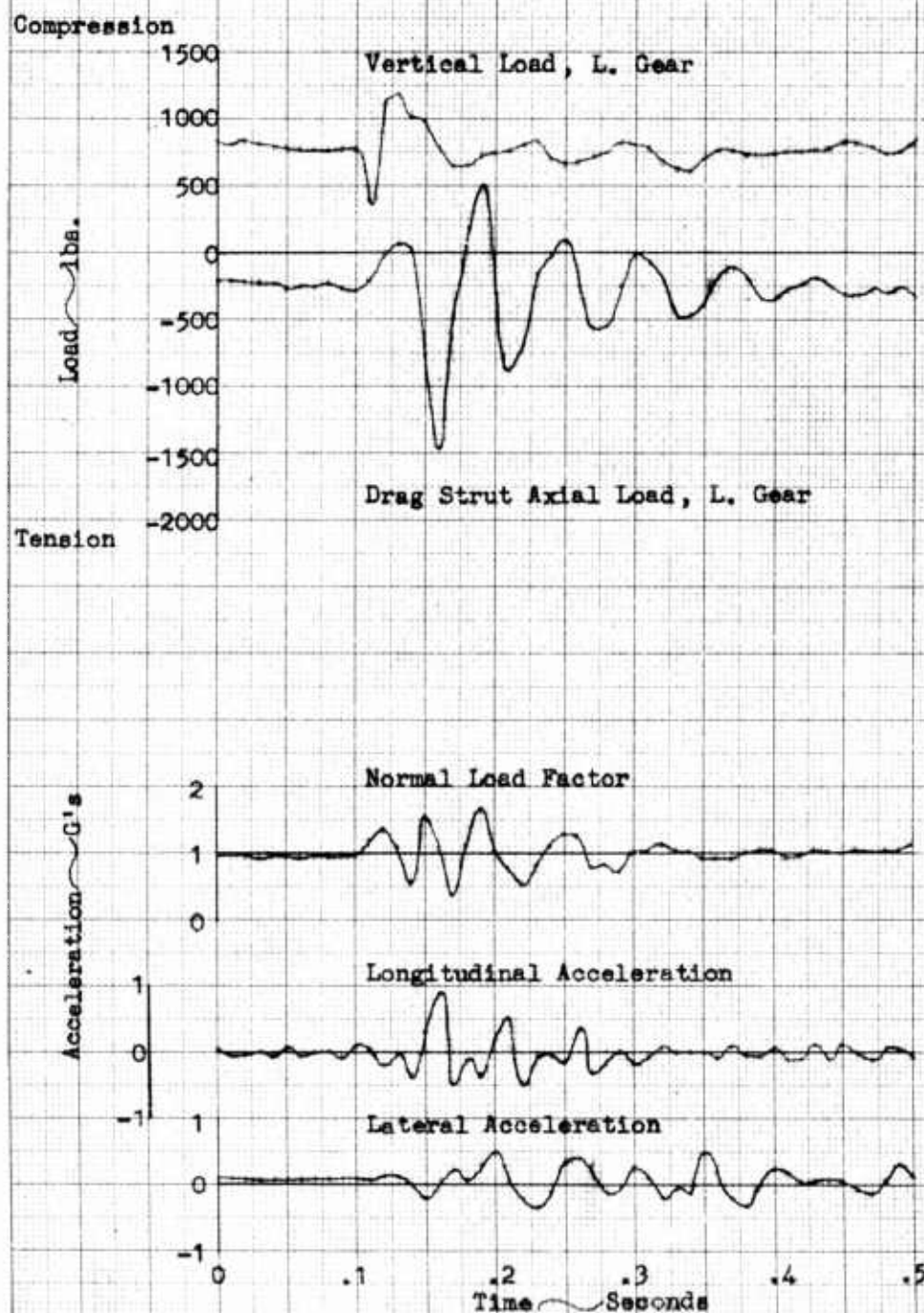


Figure 28

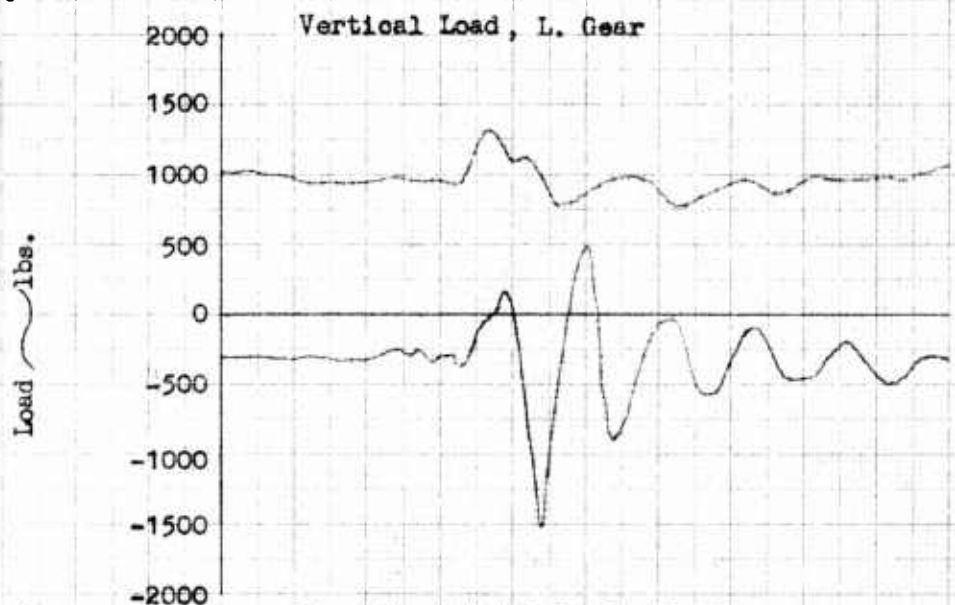
TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

Obstacle Height $2 \frac{1}{8}$ "
Record No. 24726

M245B Landing Gear
Tire Pressure 5.9 PSI

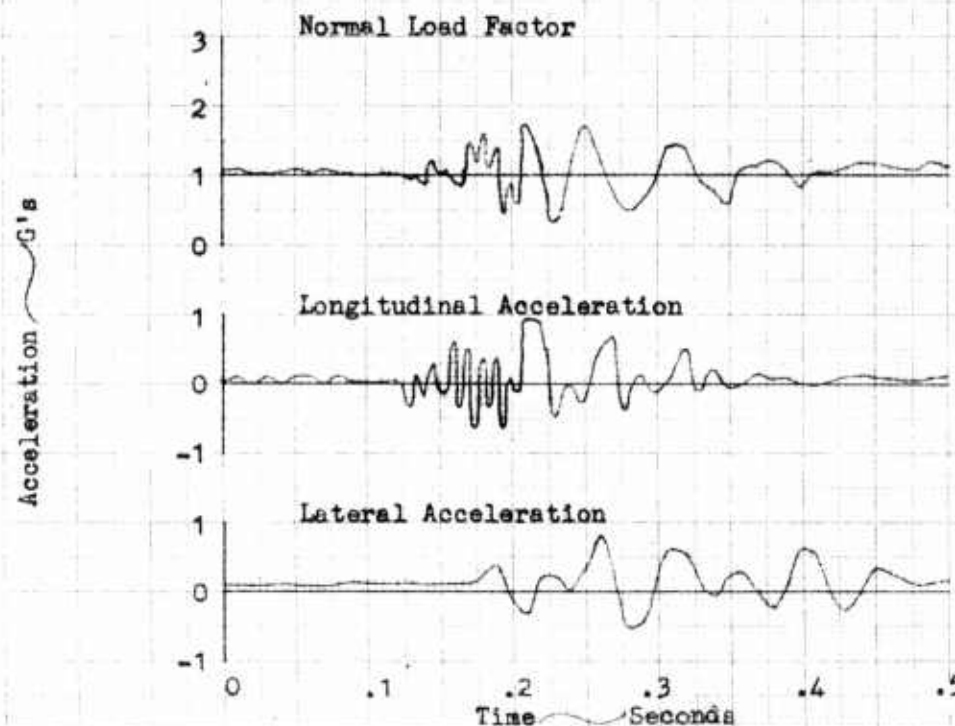
Wheel Speed 25.9 MPH
June 5, 1959
Data Req. No. L19-5

Compression



Tension

Drag Strut Axial Load, L. Gear



TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

M245B Landing Gear

Obstacle Height $4\frac{1}{4}$ "

Tire Pressure 2.7 PSI

Wheel Speed 37.3 MPH

Record No. 24733

June 5, 1959

Data Req. No. L19-5

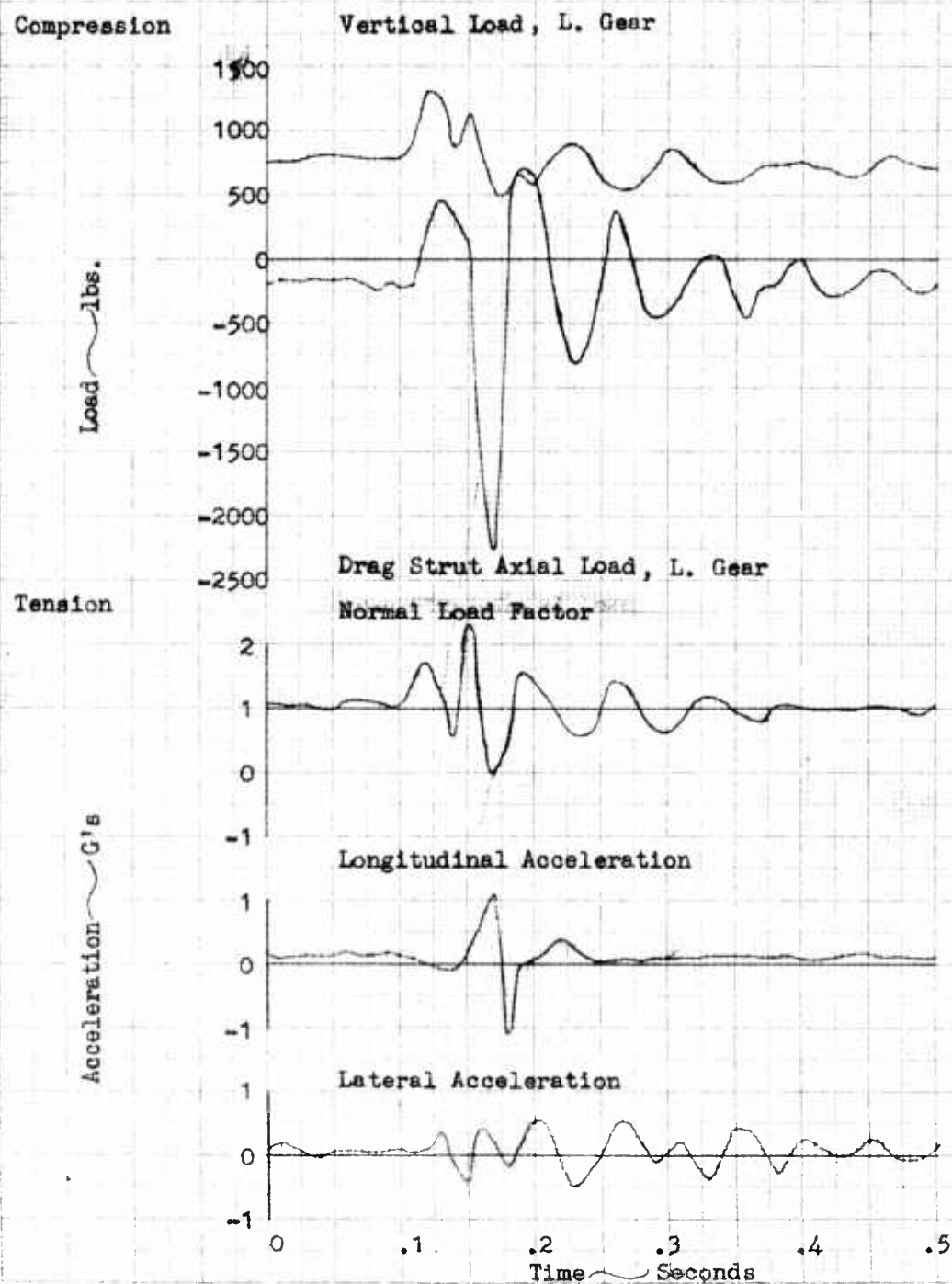


Figure 30

TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

M245B Landing Gear
 Obstacle Height $4\frac{1}{2}$ " Tire Pressure 3.6 \pm .2 PSI Wheel Speed 29.0 MPH
 Record No. 24540 May 25, 1959
 Data Req. No. L19-5

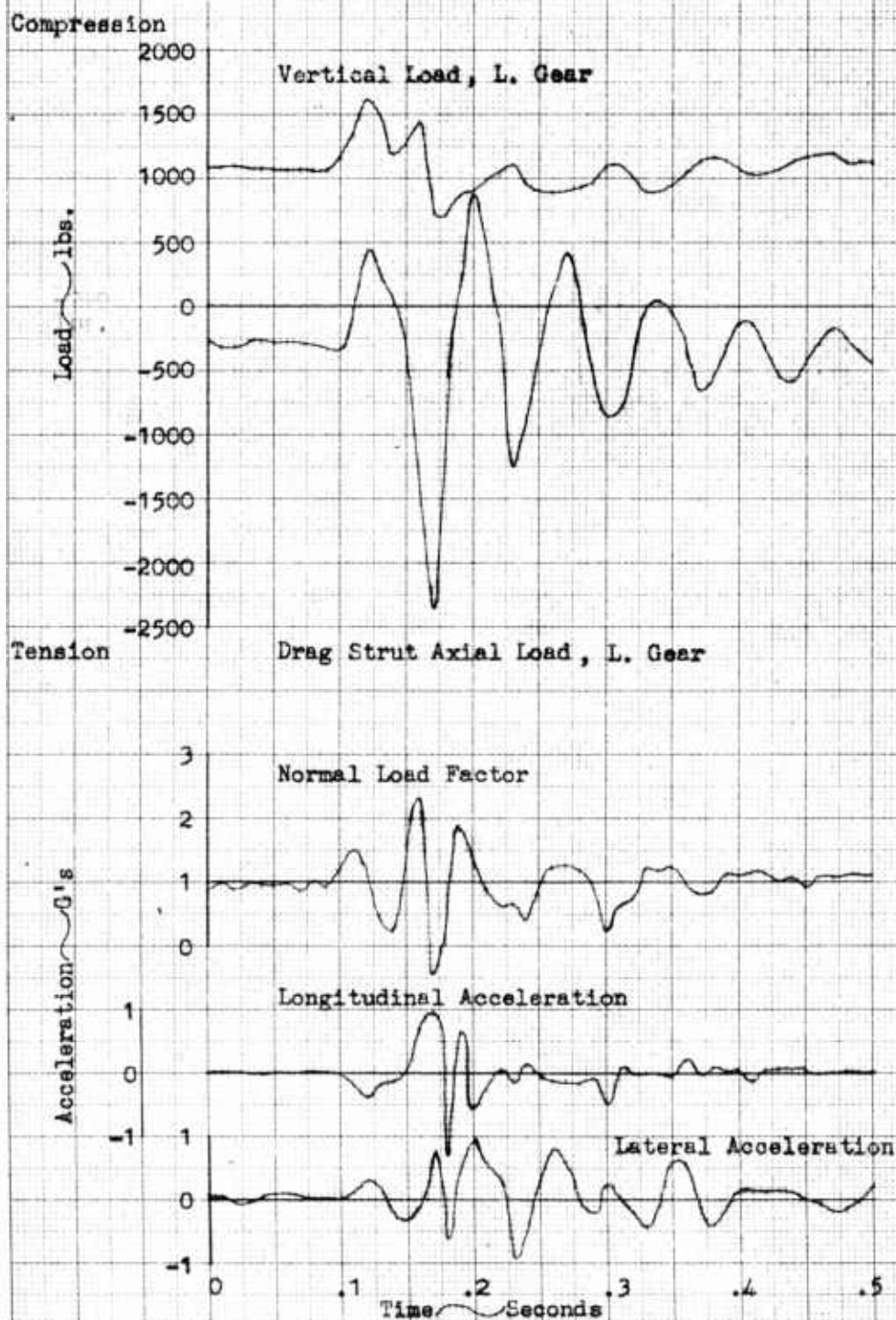


Figure 31

TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

M245B Landing Gear
Obstacle Height $4\frac{1}{4}$ " Tire Pressure 4.9 PSI Wheel Speed 23.4 MPH
Record No. 24579 May 27, 1959
Data Req. No. L19-5

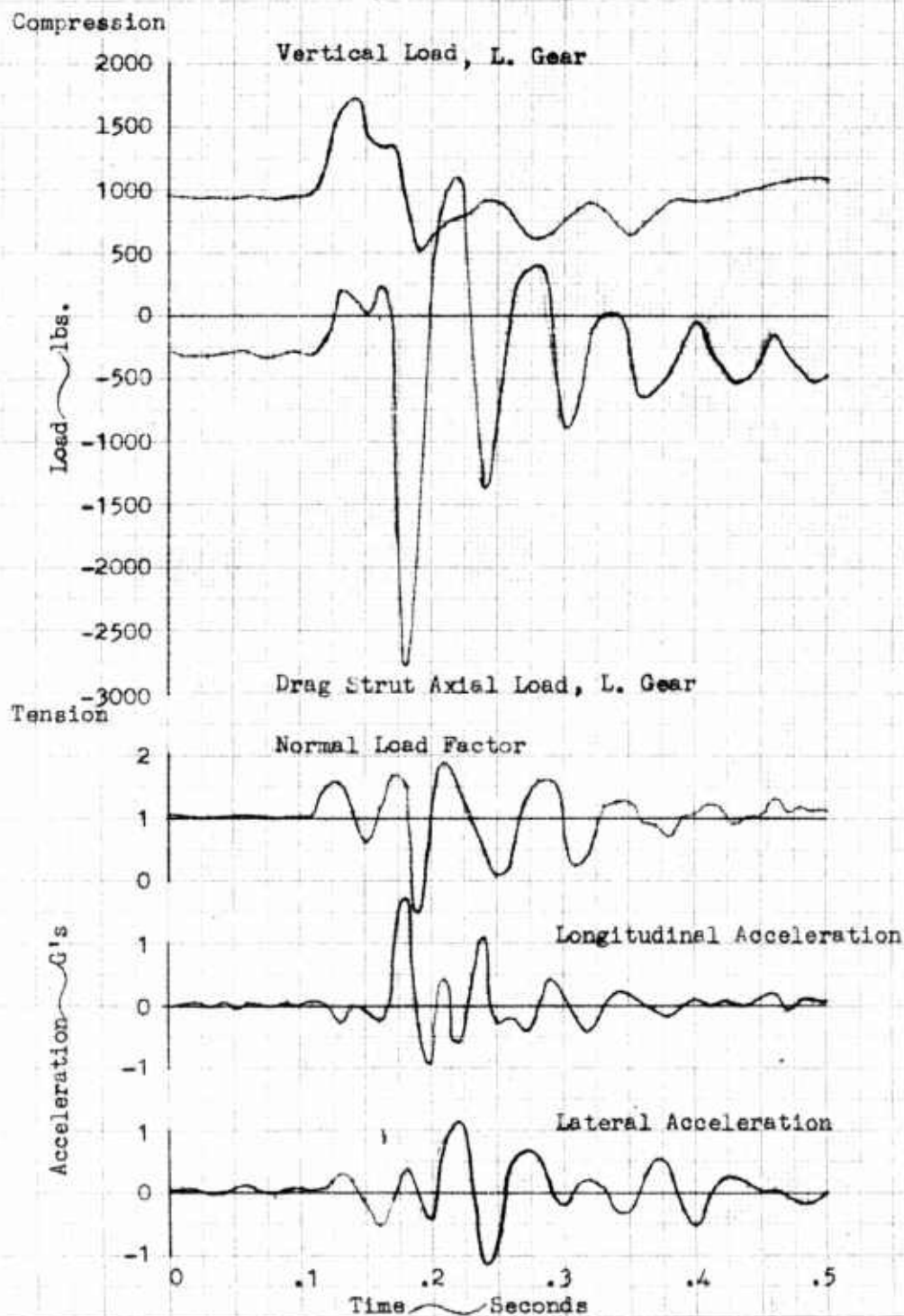


Figure 32

TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

M245B Landing Gear
 Obstacle Height 6 3/8" Tire Pressure 2.7 PSI Wheel Speed 22.4 MPH
 Record No. 24617 May 28, 1959
 Data Req. No. L19-5

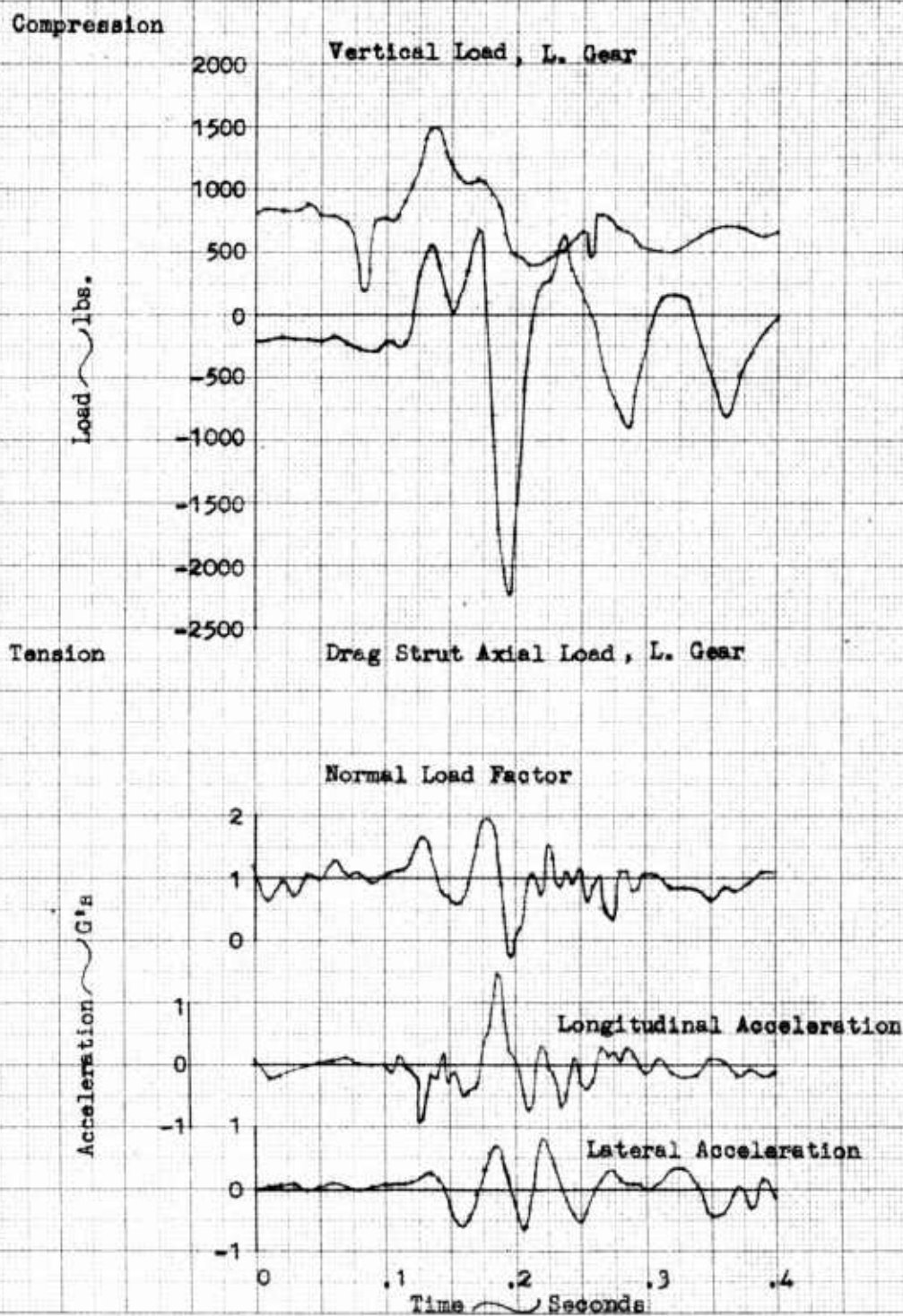


Figure 33

TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

Obstacle Height 6 3/8"

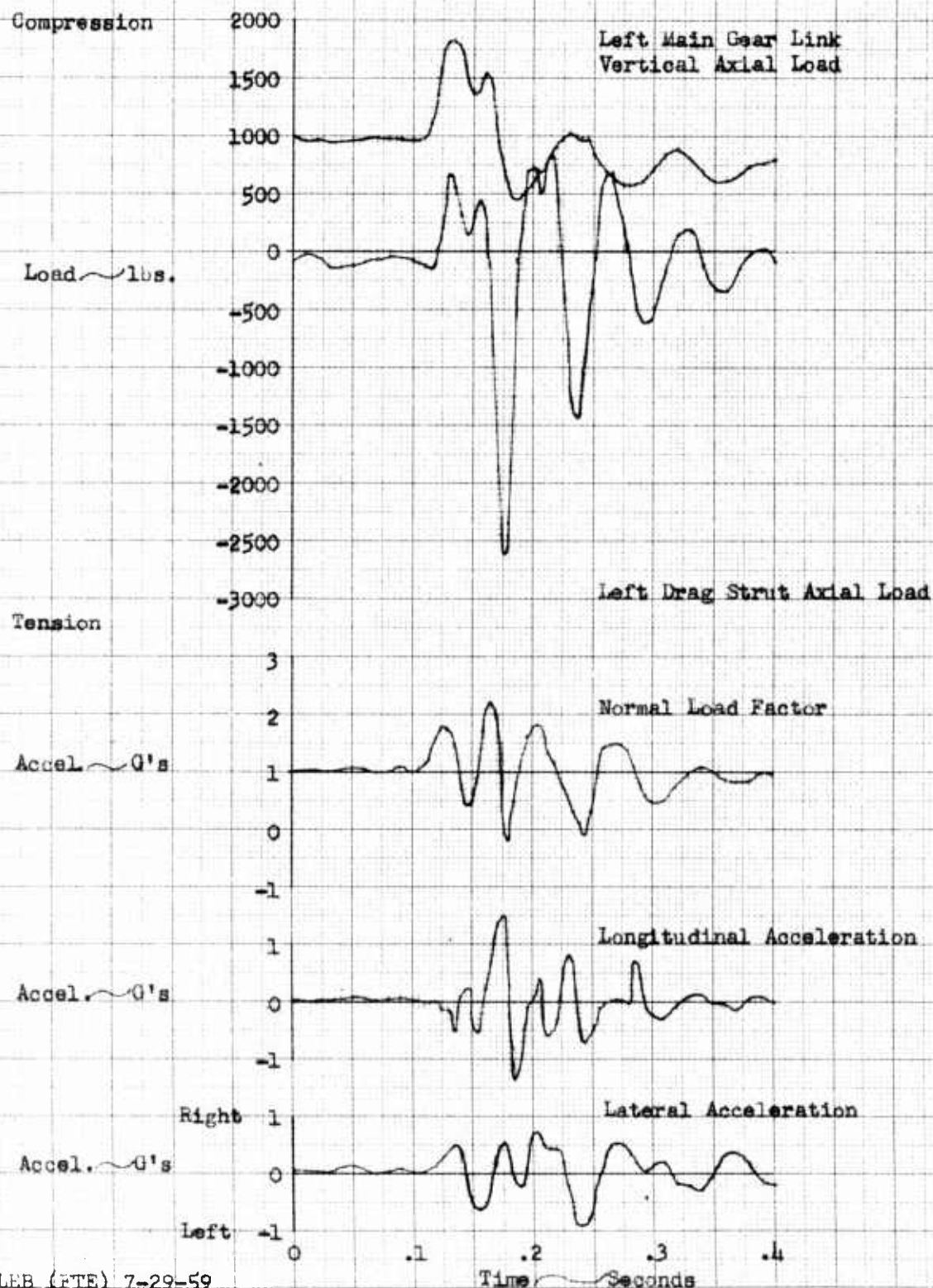
M245B Landing Gear

Tire Pressure 3.7 PSI

Wheel Speed 36.4 MPH

Record No. 25179

Data Req. No. LL9-5



LEB (FTE) 7-29-59

TIME HISTORY OF TYPICAL TAXI OVER OBSTACLE

Obstacle Height 8"

M245B Landing Gear

Tire Pressure 2.7 PSI

Wheel Speed 8.1 MPH

Record No. 24638

June 2, 1959

Data Req. No. L19-5

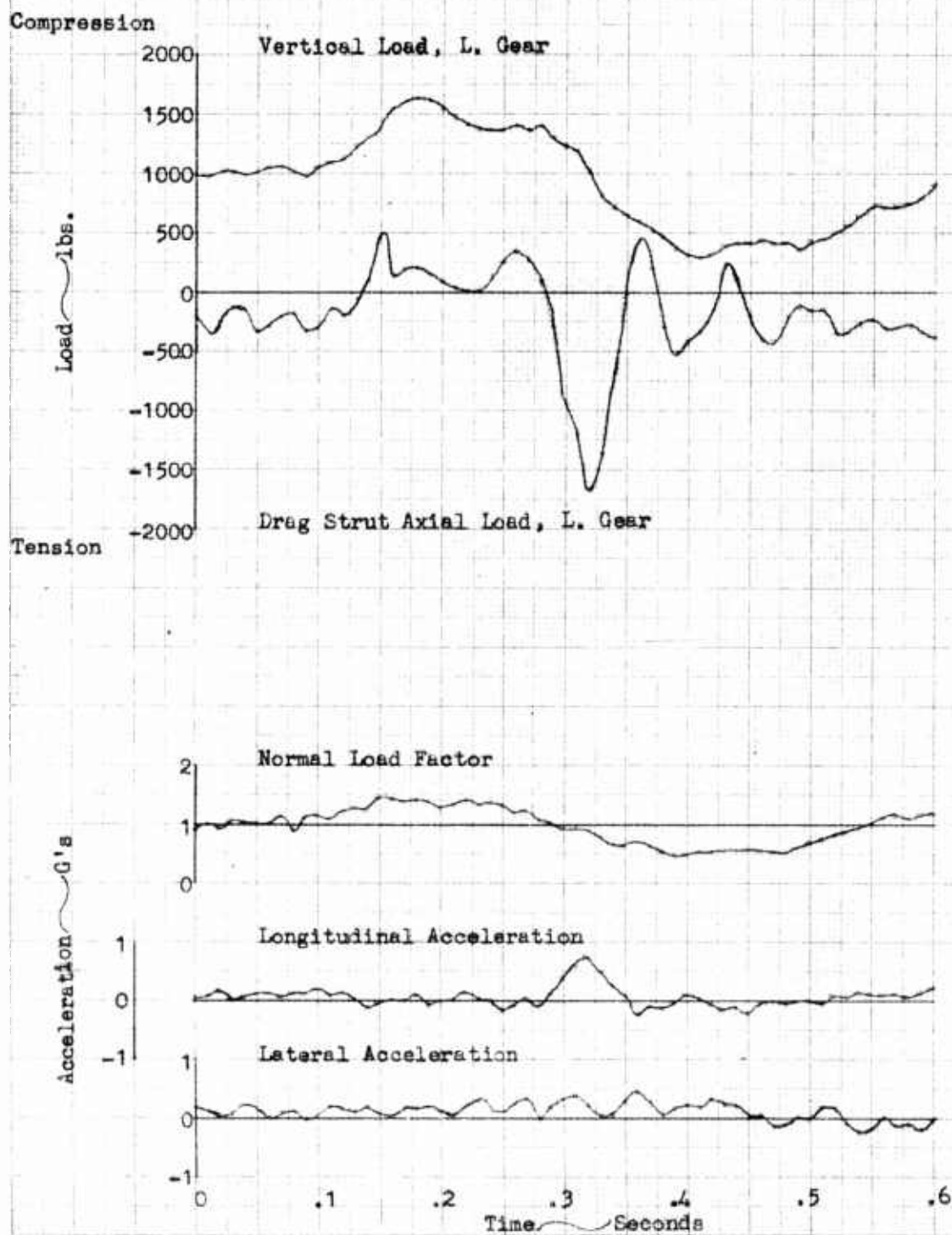


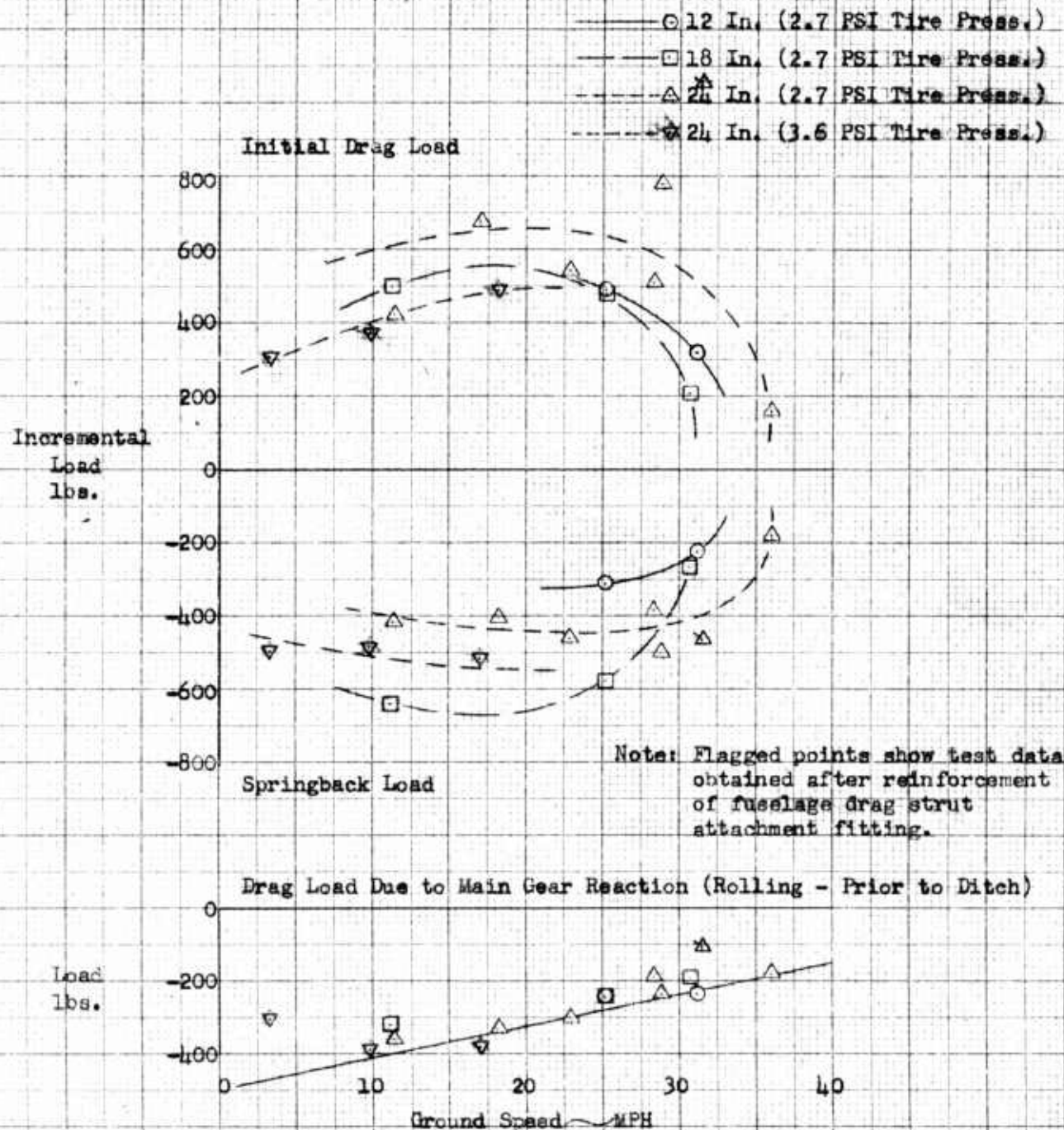
Figure 35

EFFECT OF GROUND SPEED ON DRAG STRUT AXIAL LOAD THROUGH 4 INCH DEEP DITCHES

M245B Landing Gear on L-19A Airplane

Data Request No. L-19-5

Ditch Width



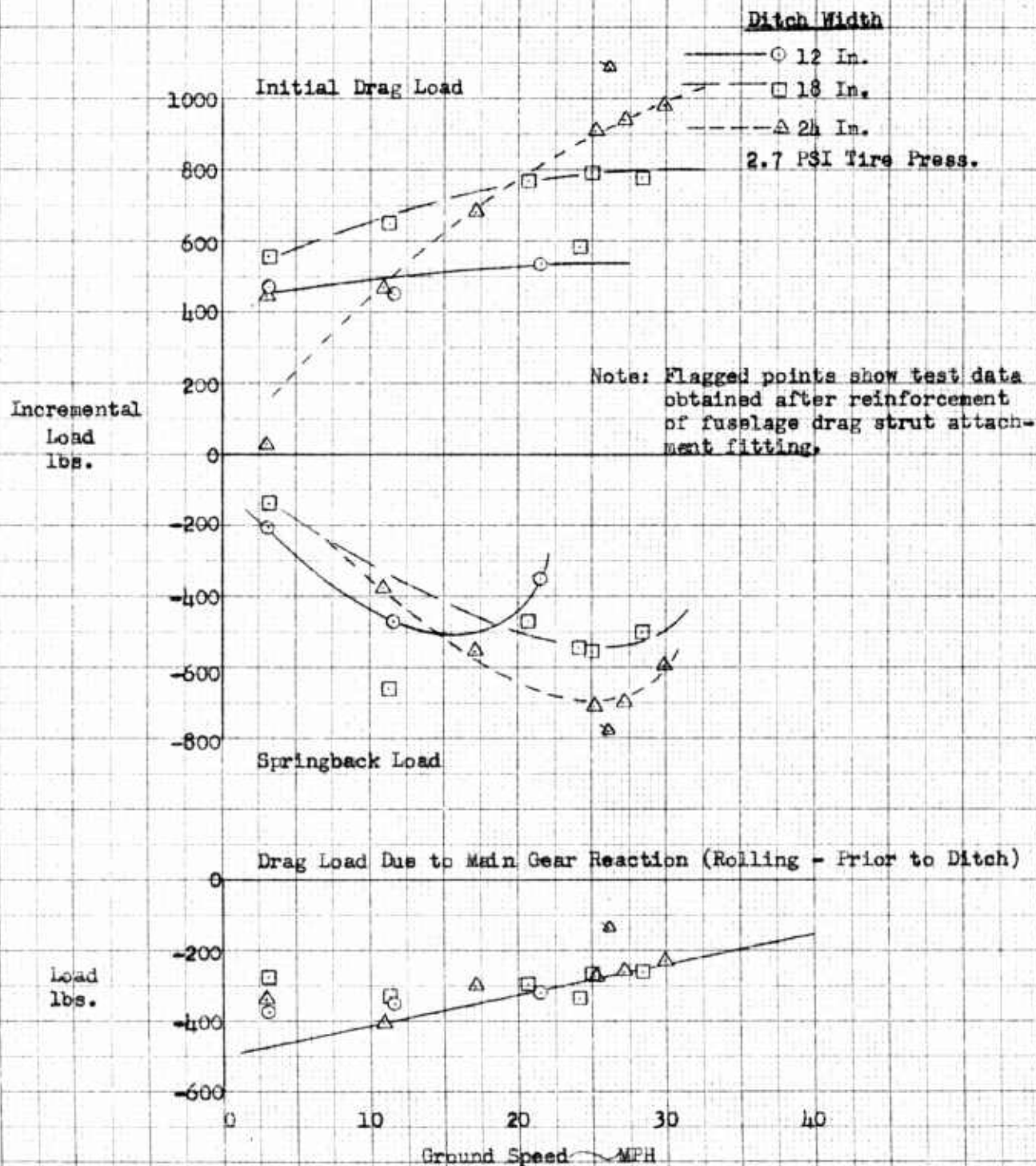
LEB (FTE) 6-25-59

10 X 10 TO THE 1/2 INCH 359T 11
ALBANY

EFFECT OF GROUND SPEED ON DRAG STRUT AXIAL LOAD THROUGH 6 INCH DEEP DITCHES.

M245B Landing Gear on L-19A Airplane

Data Request No. L-19-5



LEB (FTE) 6-25-59

10 X 10 TO THE 1/2 INCH 359T-11
 10 X 10 TO THE 1/2 INCH 359T-11
 10 X 10 TO THE 1/2 INCH 359T-11

EFFECT OF GROUND SPEED ON DRAG STRUT AXIAL LOAD THROUGH 8 INCH DEEP DITCHES

M245B Landing Gear on L-19A Airplane

Data Request No. L-19-5

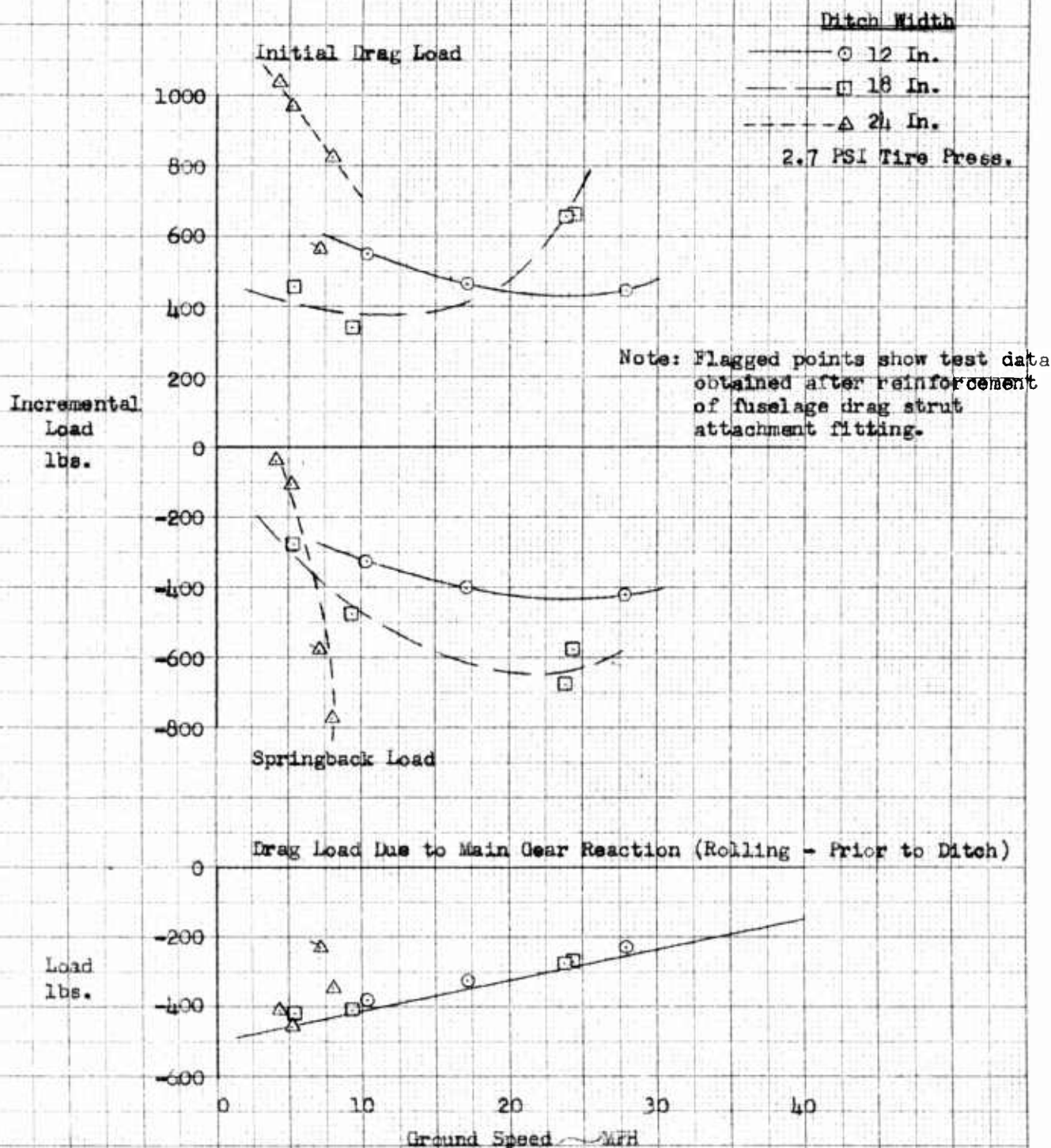


Figure 38

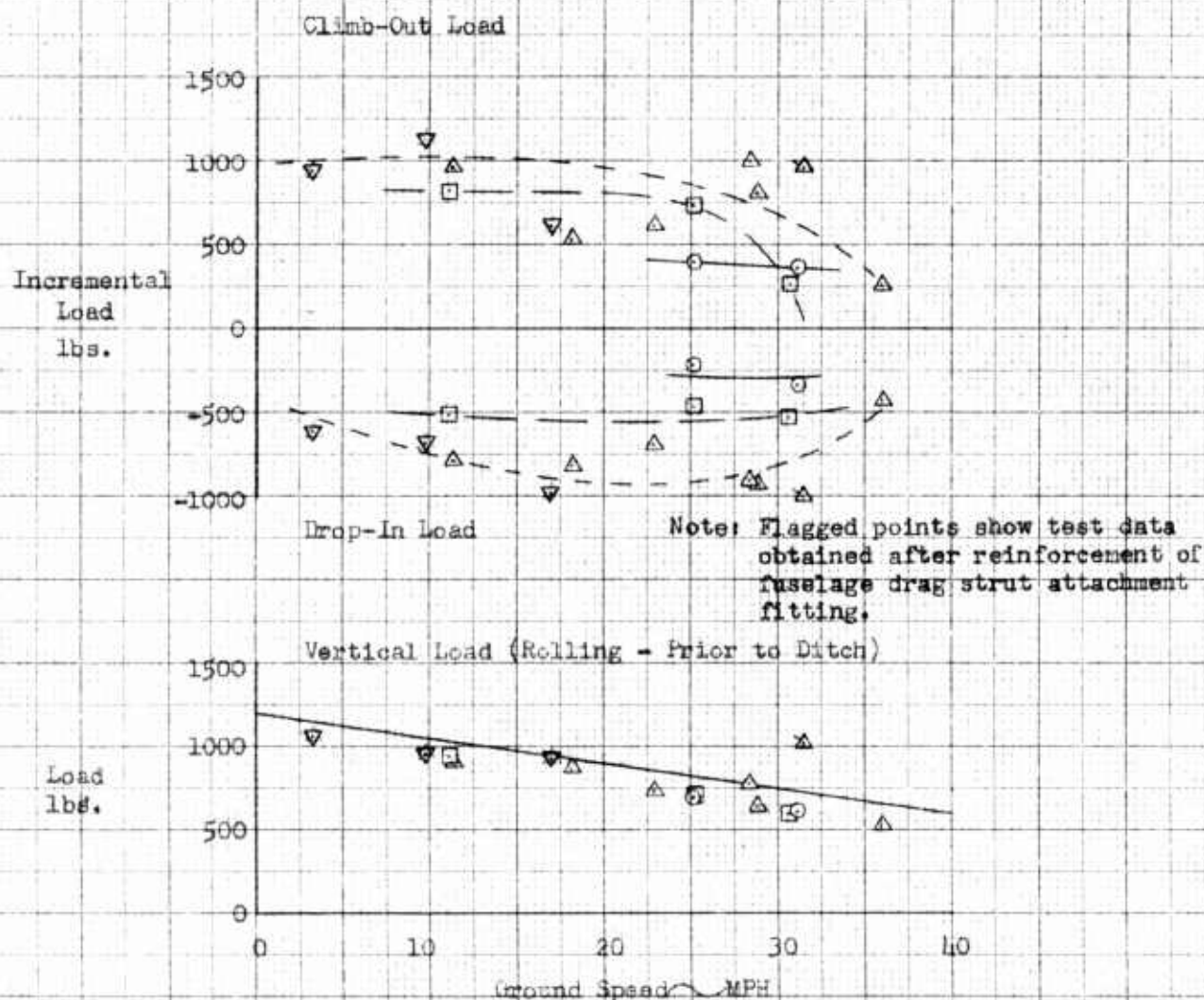
EFFECT OF GROUND SPEED ON VERTICAL LINK AXIAL LOAD THROUGH 4 INCH DEEP DITCH

M245B Landing Gear on L-19A Airplane

Data Request No. L-19-5

Ditch Width

- 12 In. (2.7 PSI Tire Press.)
- 18 In. (2.7 PSI Tire Press.)
- △--- 24 In. (2.7 PSI Tire Press.)
- ▽--- 24 In. (3.6 PSI Tire Press.)



LEE (ITE) 6-29-59

REF 10 X 10 TO THE 1/2 INCH 359T 11
V. F. 3551R CO. 1
ALBANY, N. Y.

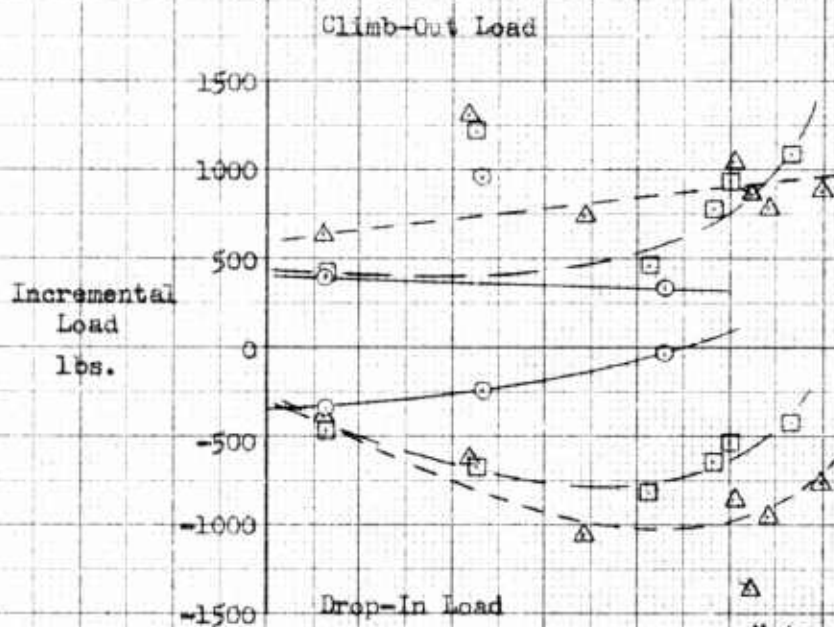
Figure 39

EFFECT OF GROUND SPEED ON VERTICAL LINE AXIAL LOAD THROUGH 6 INCH DEEP DITCH
W245B Landing Gear on L-19A Airplane

Data Request No. L-19-5

Ditch Width

- 12 In. (2.7 PSI Tire Press.)
- 18 In. (2.7 PSI Tire Press.)
- △--- 24 In. (2.7 PSI Tire Press.)



Note: Flagged points show test data obtained after reinforcement of fuselage drag strut attachment fitting.

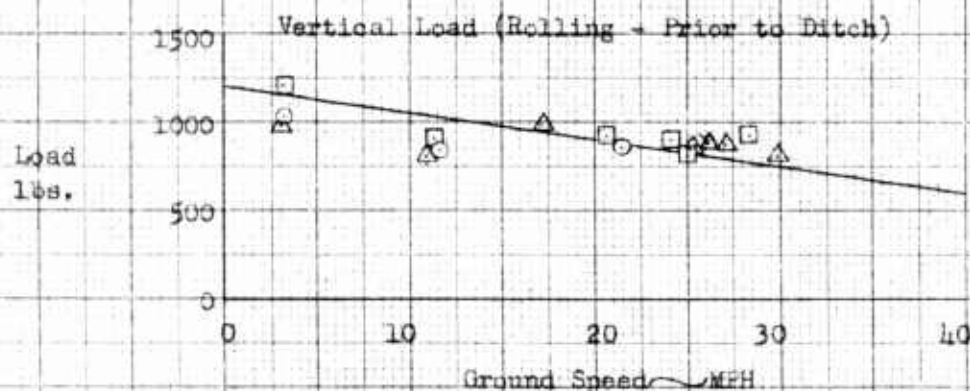


Figure 40

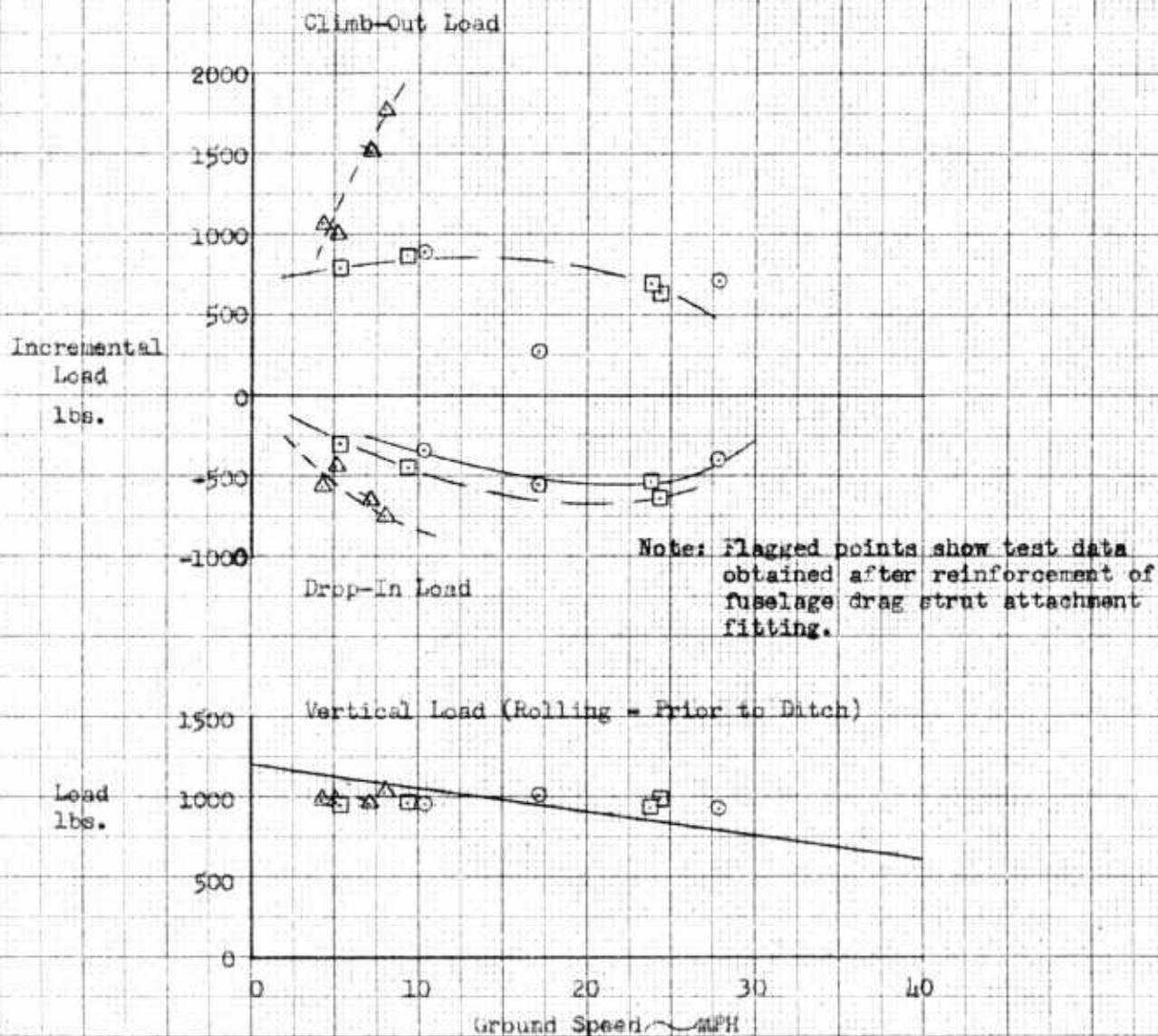
EFFECT OF GROUND SPEED ON VERTICAL LINK AXIAL LOAD THROUGH 8 INCH DEEP DITCH

M245B Landing Gear on L-19A Airplane

Data Request No. L-19-5

Ditch Width

- 12 In. (2.7 PSI Tire Press.)
- 16 In. (2.7 PSI Tire Press.)
- △--- 24 In. (2.7 PSI Tire Press.)



10 X 10 TO THE 1/2 INCH
359T-11
-2-11-59
-2-11-59
-2-11-59

Figure 41

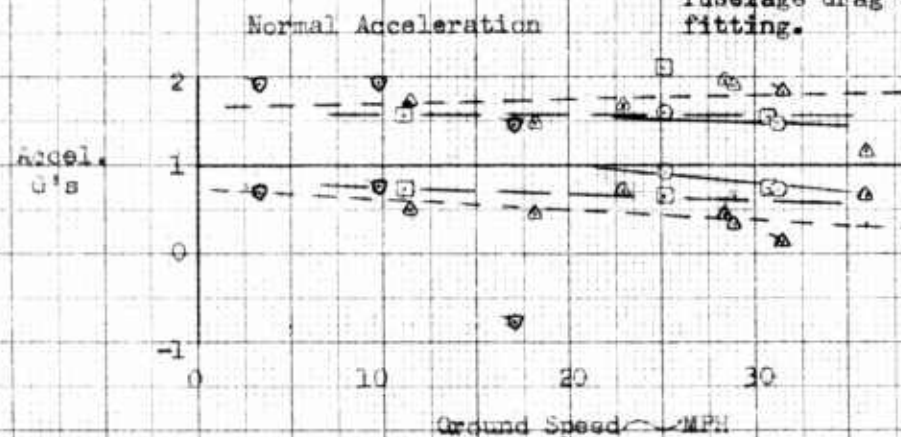
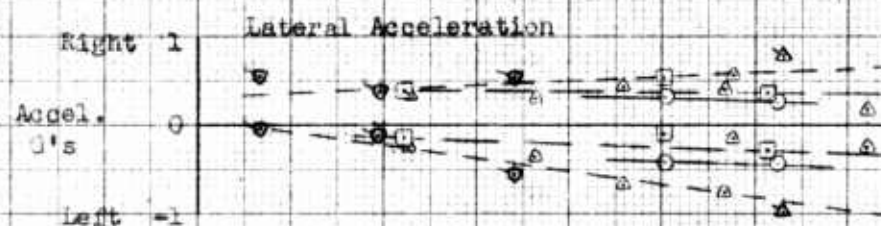
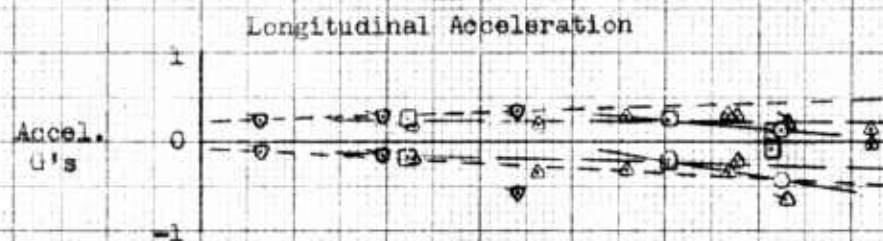
EFFECT OF GROUND SPEED ON AIRPLANE ACCELERATIONS THROUGH LENCE DEEP DITCH

M245B Landing Gear on L-19A Airplane

Data Request No. L-19-5

Ditch Width

- 12 In. (2.7 PSI Tire Press.)
- 18 In. (2.7 PSI Tire Press.)
- △--- 24 In. (2.7 PSI Tire Press.)
- ▽----- 24 In. (3.6 PSI Tire Press.)



Note: Flagged points show test data obtained after reinforcement of fuselage drag strut attachment fitting.

EFFECT OF GROUND SPEED ON AIRPLANE ACCELERATIONS THROUGH 6 INCH DEEP DITCH

M245B Landing Gear on L-19A Airplane

Data Request No. L-19-5

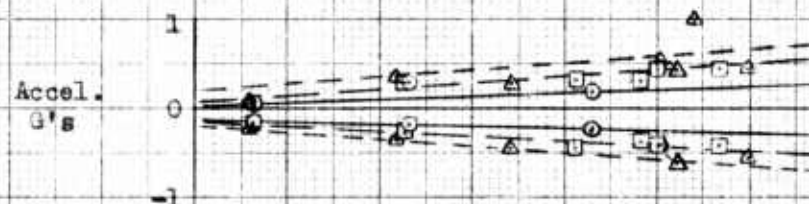
Ditch Width

—○— 12 In. (2.7 PSI Tire Press.)

—□— 18 In. (2.7 PSI Tire Press.)

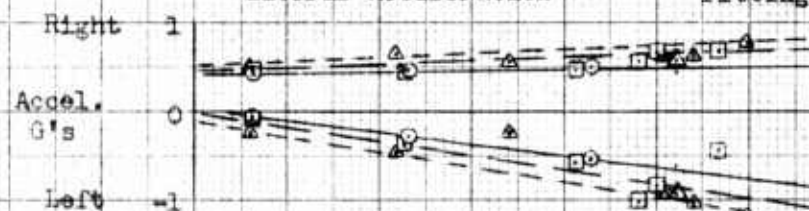
—△— 24 In. (2.7 PSI Tire Press.)

Longitudinal Acceleration

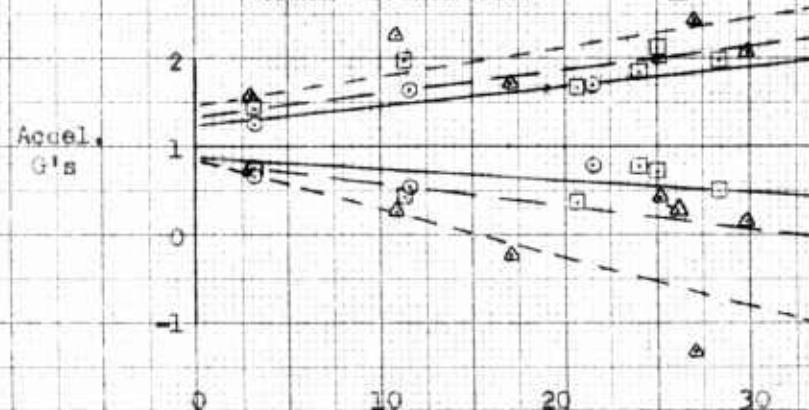


Note: Flagged points show test data obtained after reinforcement of fuselage drag strut attachment fitting.

Lateral Acceleration



Normal Acceleration



Ground Speed — MPH

RHS (PTE) 6-29-59

10 X 10 TO THE 1/2 INCH 359T-11

1/2 X 1/2 TO THE 1/2 INCH 359T-11

1/2 X 1/2 TO THE 1/2 INCH 359T-11

Figure 43

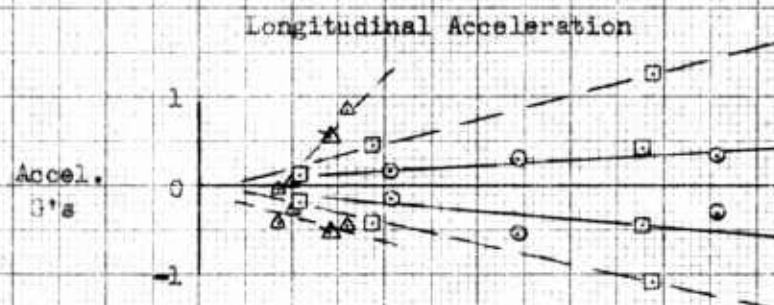
EFFECT OF GROUND SPEED ON AIRPLANE ACCELERATIONS THROUGH 8 INCH DEEP DITCH

M245B Landing Gear on L-19A Airplane

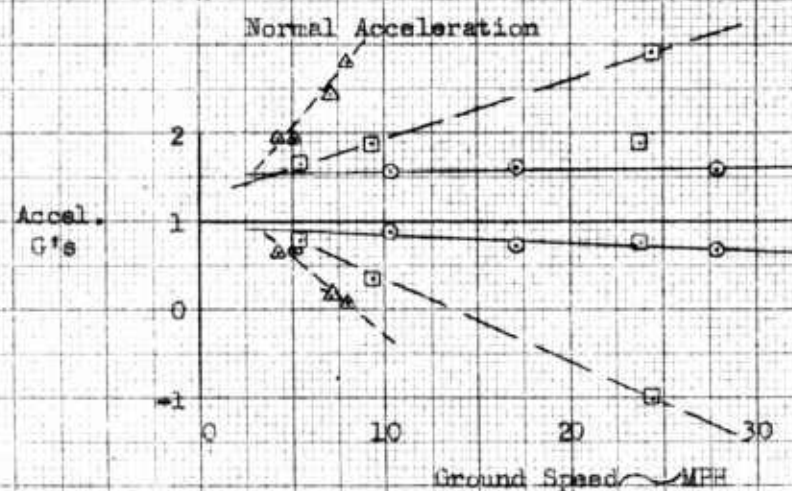
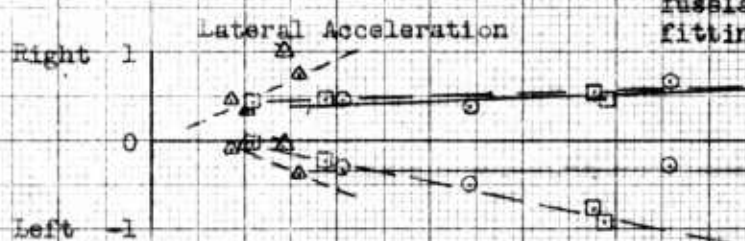
Data Request No. L-19-5

Ditch Width

- 12 In. (2.7 PSI Tire Press.)
 —□— 16 In. (2.7 PSI Tire Press.)
 - - -△- 24 In. (2.7 PSI Tire Press.)



Note: Flagged points show test data obtained after reinforcement of fuselage drag strut attachment fitting.



RHS (FTE) 6-29-59

K-2 10 X 10 TO THE 1/2 INCH 359T-11
 KUPPEL & ESSER CO. ALBANY, N.Y.

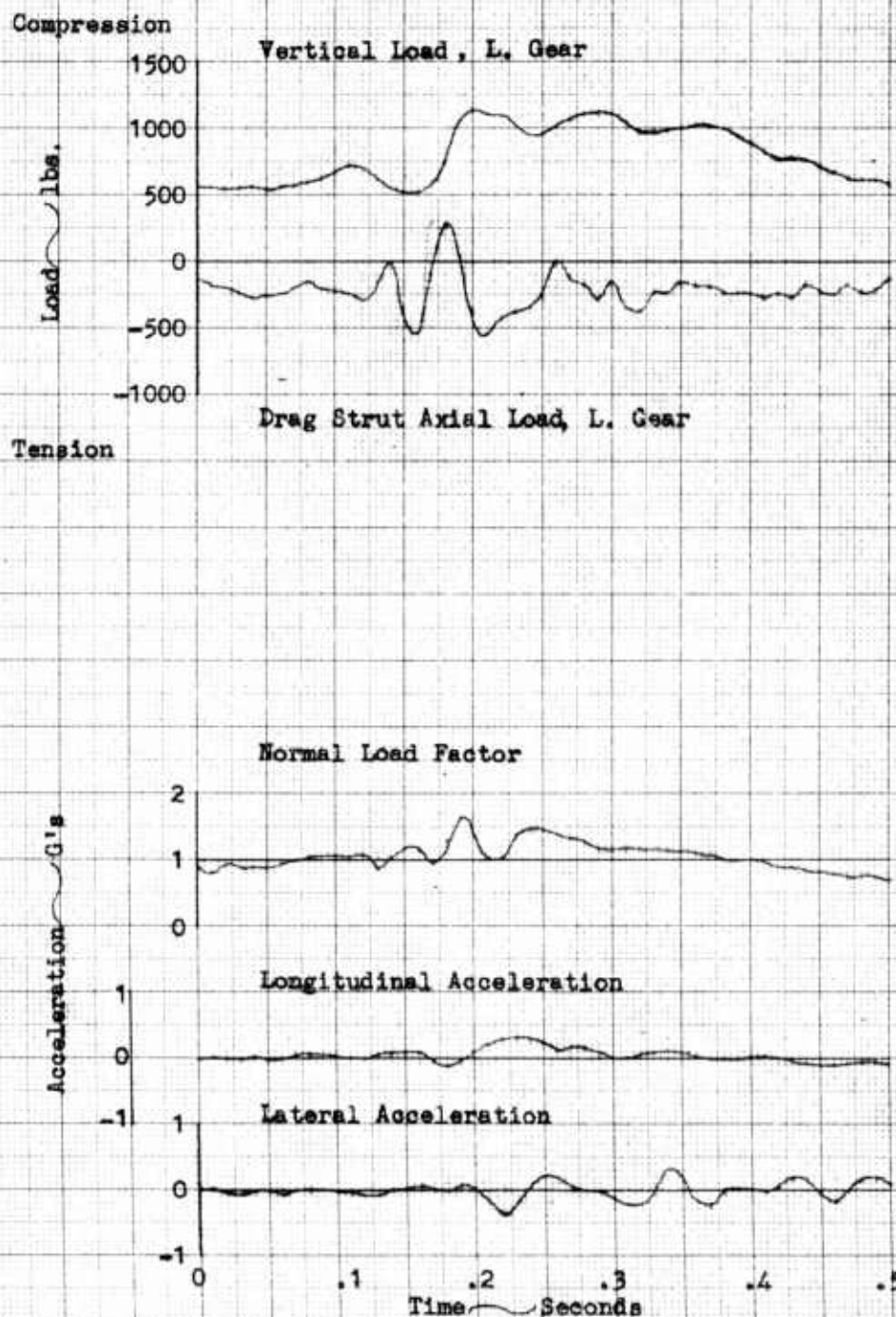
Figure 44

TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

Ditch Size 12"W x 4"D
Record No. 24641

M245B Landing Gear
Tire Pressure 2.7 PSI

Wheel Speed 25.2 MPH
June 2, 1959
Data Req. No. L19-5



TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

Ditch Size 18"W x 4"D
Record No. 24643

M245B Landing Gear
Tire Pressure 2.7 PSI

Wheel Speed 11.1 MPH
June 2, 1959
Data Req. No. L19-5

Compression

2000
1500
1000
500
0
-500
-1000
-1500
Load lbs.

Vertical Load, L. Gear

Tension

Drag Strut Axial Load, L. Gear

Normal Load Factor

3
2
1
0

Acceleration G's

Longitudinal Acceleration

Lateral Acceleration

1
0
-1

0

.1

.2

.3

.4

.5

.6

Time Seconds

10X10 TO THE CM
359T-14
K&S
PEPPER, B. E. (C)
ALABAMA

TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

M245B Landing Gear

Ditch Size 24"W x 4"D

Tire Pressure 2.7 PSI

Wheel Speed 11.3 MPH

Record No. 24646

June 2, 1959

Data Req. No. L19-5

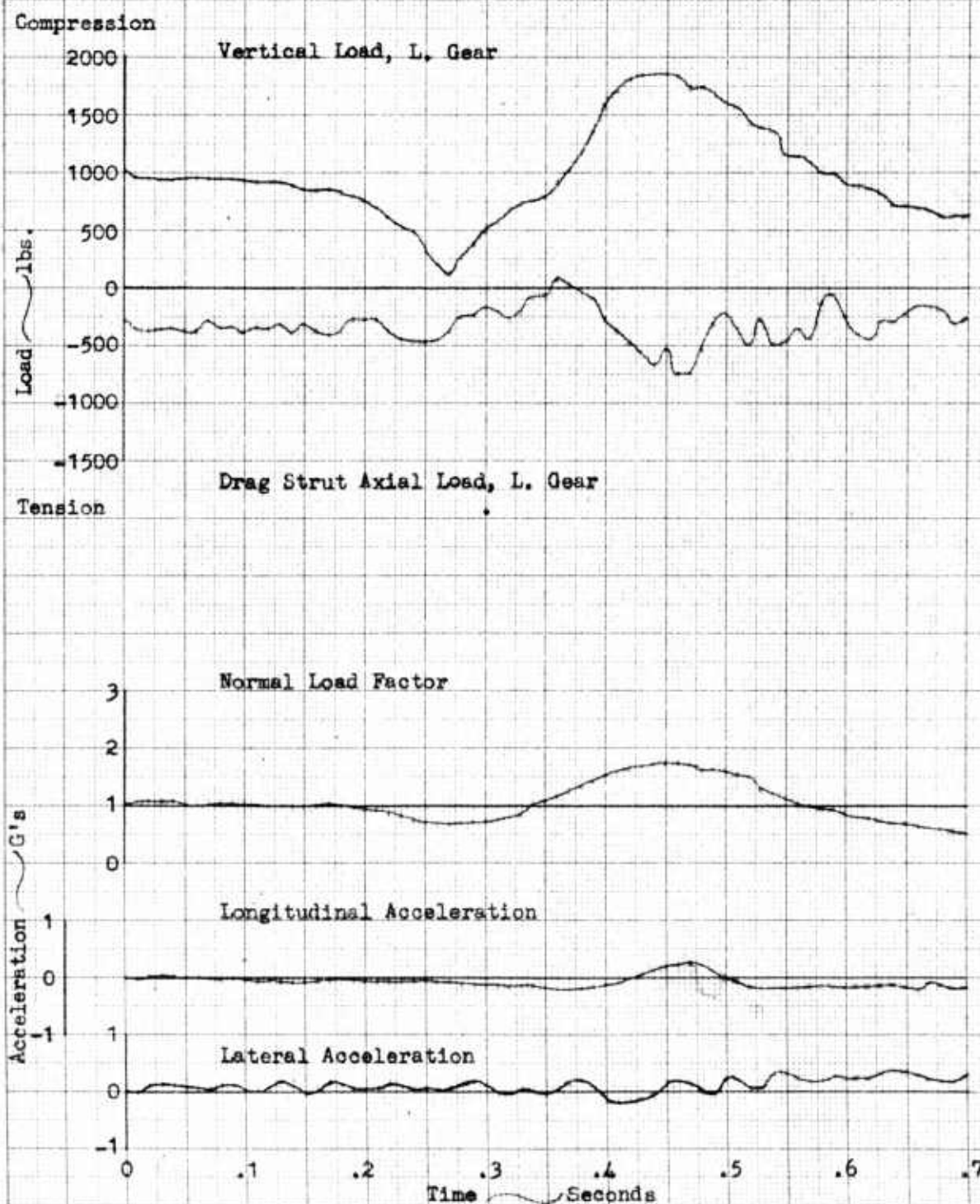


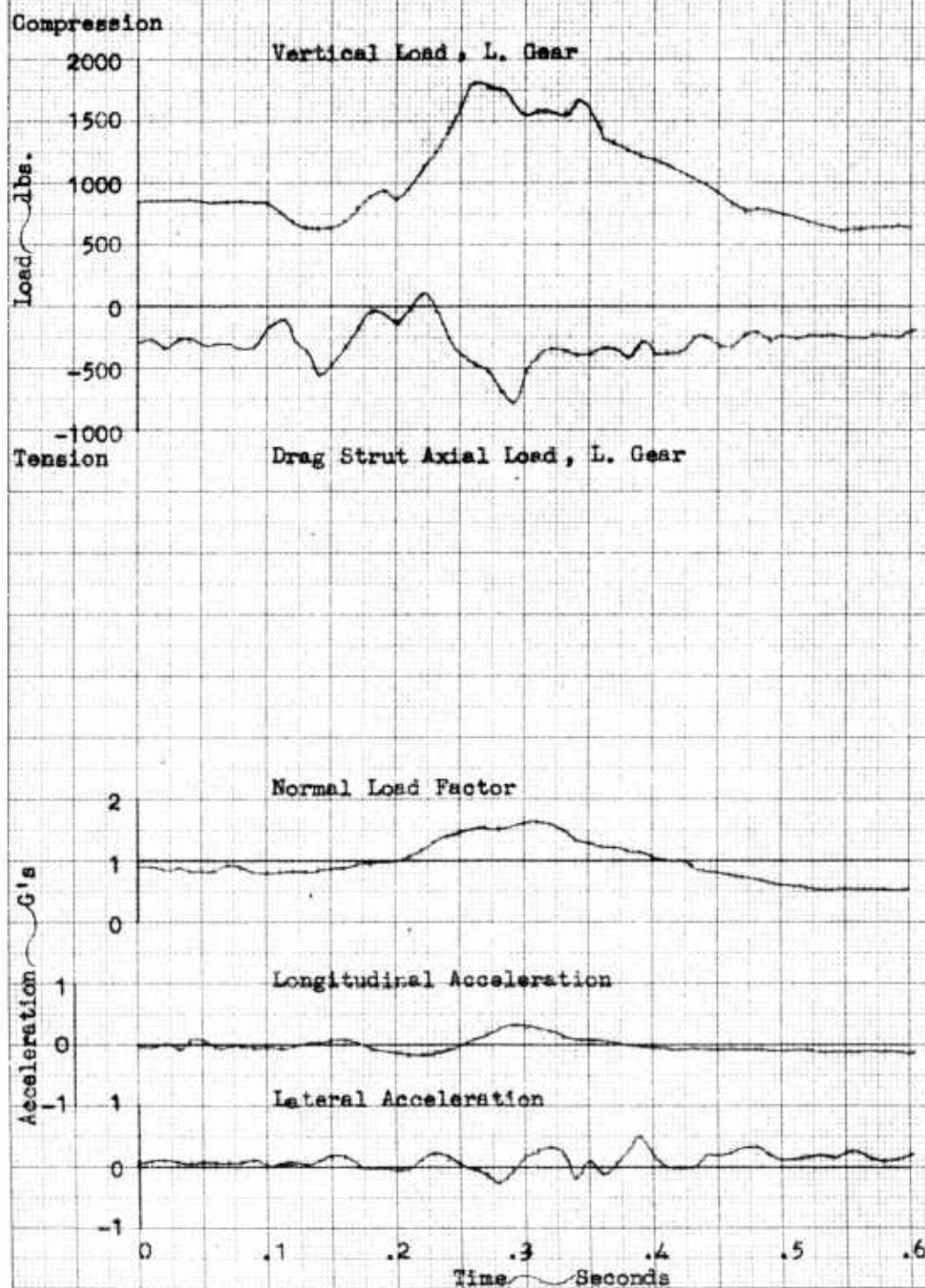
Figure 47

TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

Ditch Size 12"W x 6"D
Record No. 24663

M245B Landing Gear
Tire Pressure 2.7 PSI

Wheel Speed 11.6 MPH
June 3, 1959
Data Rec. No. L19-5



TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

M245E Landing Gear

Ditch Size 18"Wx6"D

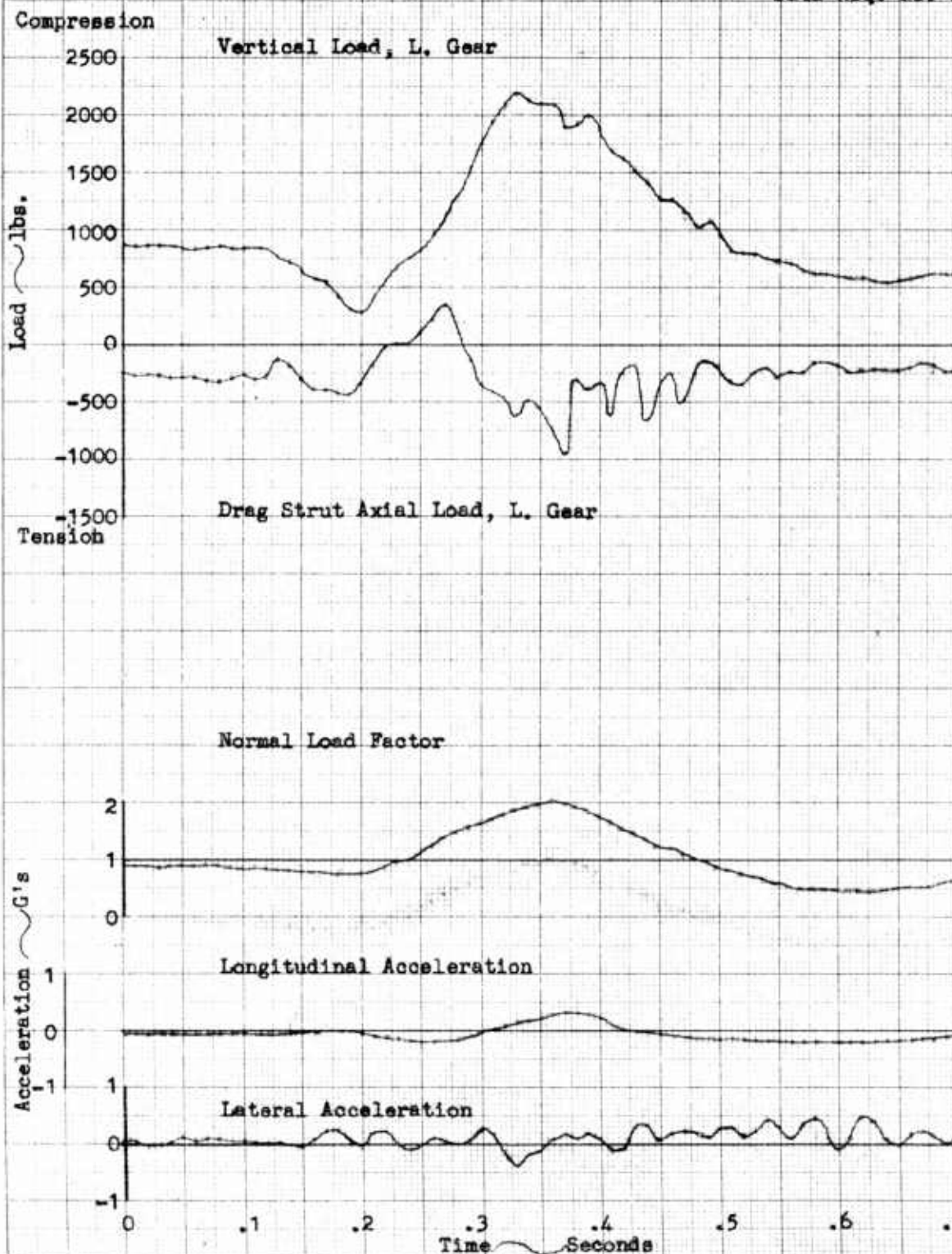
Tire Pressure 2.7 PSI

Wheel Speed 11.3 MPH

Record No. 24666

June 3, 1959

Data Req. No. L19-5



TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

M245B Landing Gear

Ditch Size 24"W x 6"D

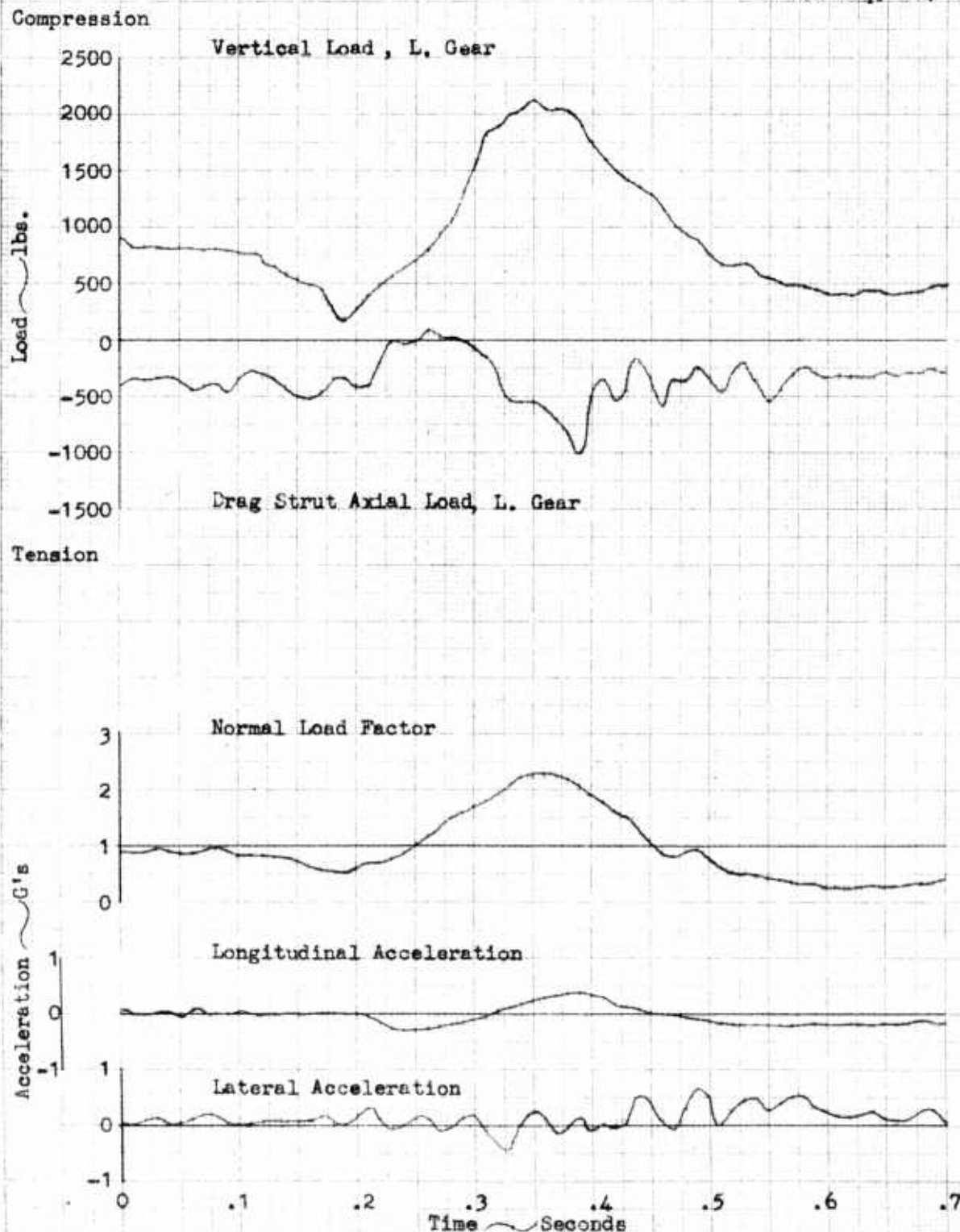
Tire Pressure 2.7 PSI

Wheel Speed 10.9 MPH

Record No. 24681

June 4, 1959

Data Req. No. L19-5



TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

M245B Landing Gear

Ditch Size 12"W x 8"D

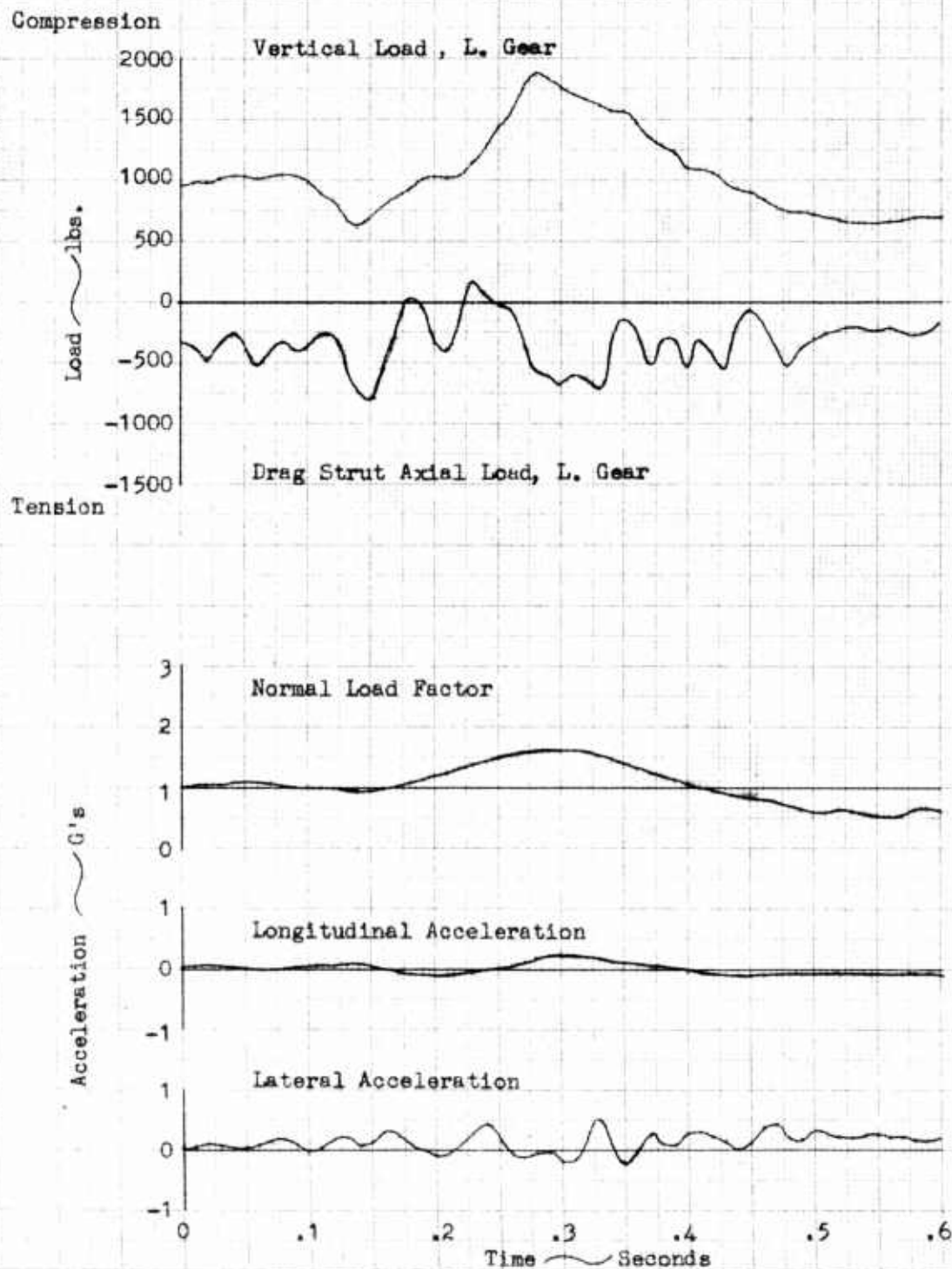
Tire Pressure 2.7 PSI

Wheel Speed 10.3 MPH

Record No. 24712

June 5, 1959

Data Req. No. L19-5



TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

M245B Landing Gear

Ditch Size 18"W x 8"D

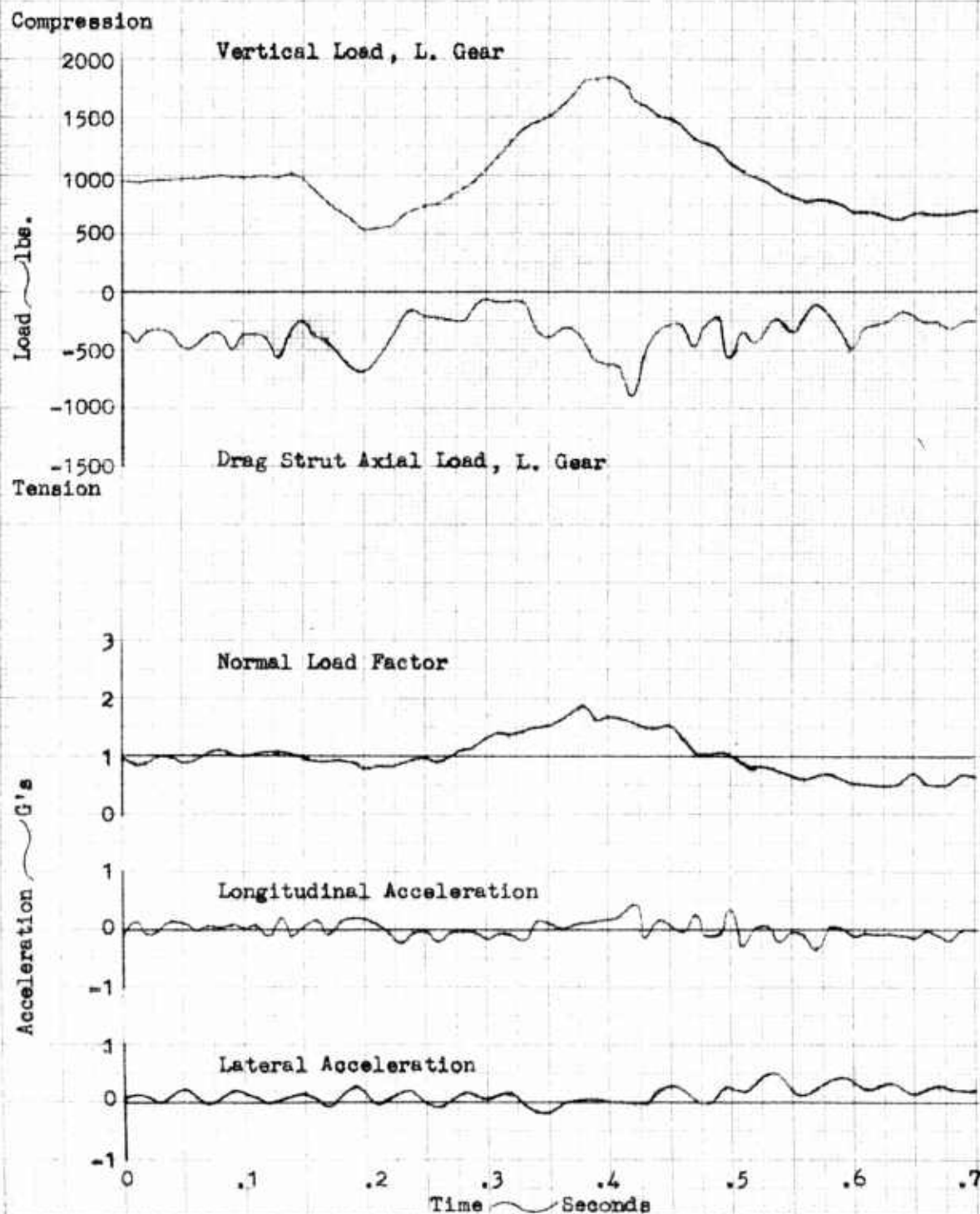
Tire Pressure 2.7 PSI

Wheel Speed 9.4 MPH

Record No. 24716

June 5, 1959

Data Req. No. L19-5



TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

Ditch Size 24"W x 8"D

M245B Landing Gear

Tire Pressure 2.7 PSI

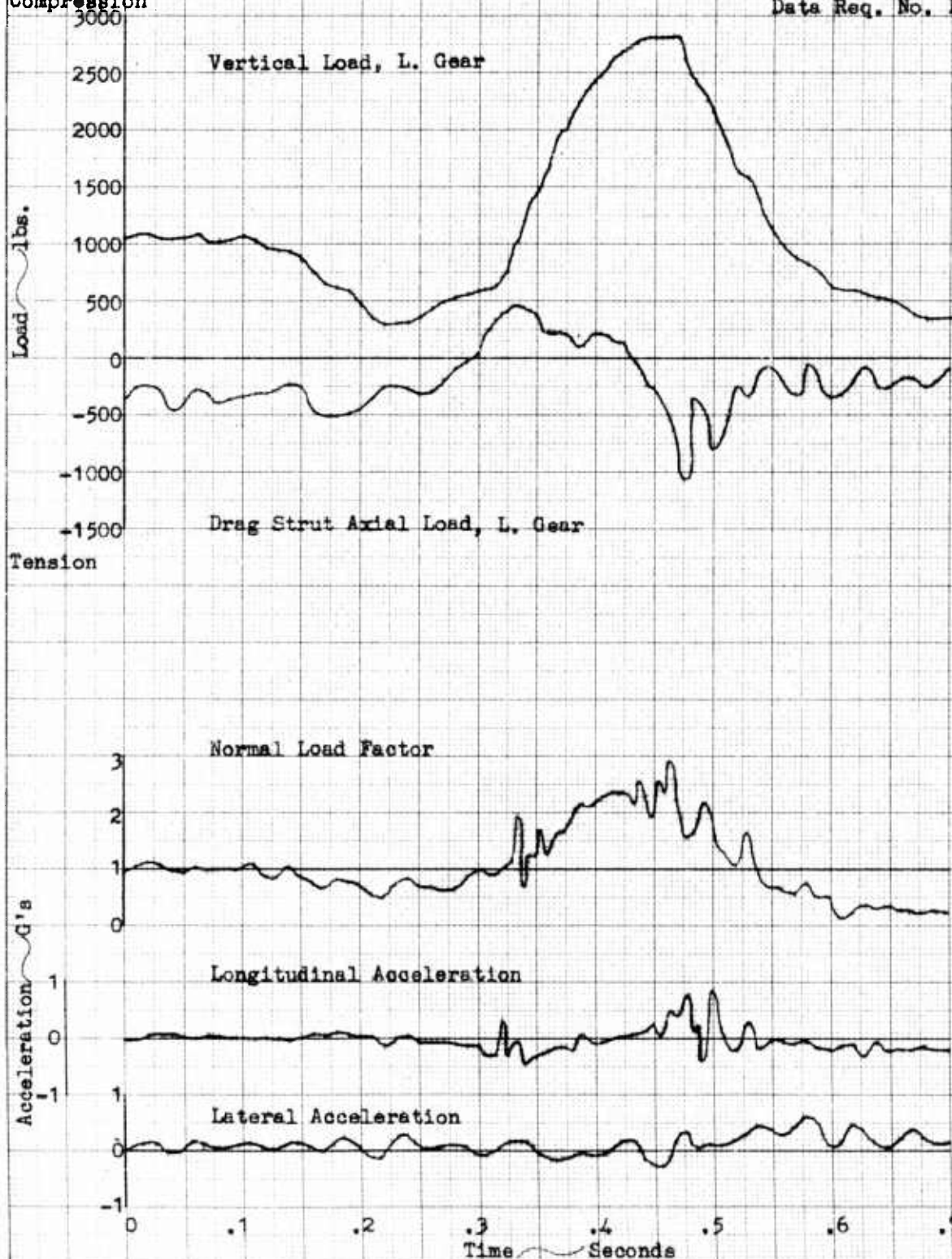
Wheel Speed 8.0 MPH

Record No. 24750

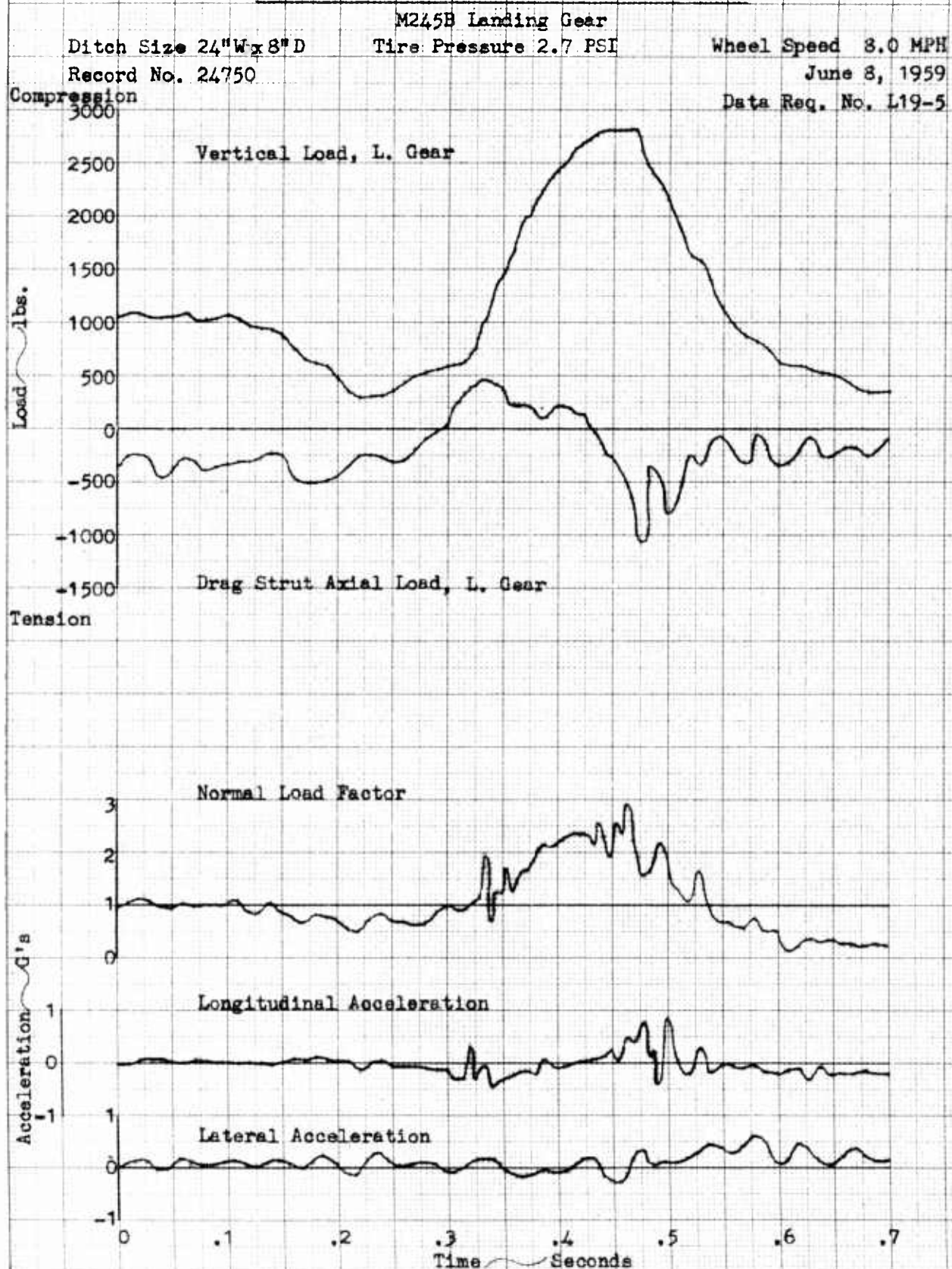
June 8, 1959

Compression

Data Req. No. L19-5



TIME HISTORY OF TYPICAL TAXI THROUGH DITCH



K&E 10X10 TO THE CM 359T-14
KEUFFEL & ESSER CO.
ALBANY, N.Y.

TIME HISTORY OF TYPICAL TAXI THROUGH DITCH

M245B Landing Gear

Ditch Size 24"Wx4"D

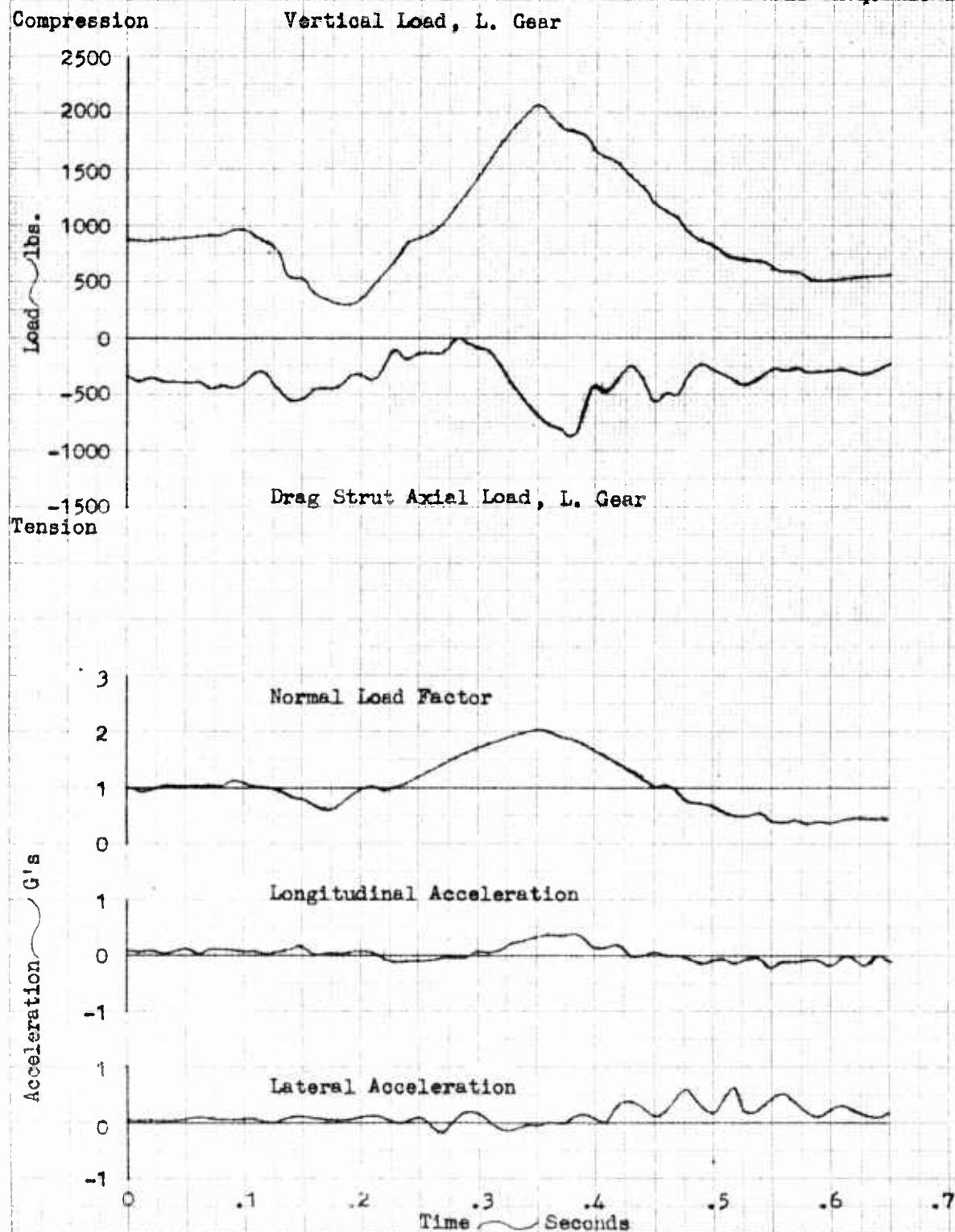
Tire Pressure 3.6 \pm .2 PSI

Wheel Speed 9.8 MPH

Record No. 24729

June 5, 1959

Data Req. No. L19-5



K Σ 10X10 TO THE CW 359T-14
KEUFFEL & ESSER CO. WATLING S.
ALBANY N.Y.

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Figure 54

N245B HIGH FLOTATION GEAR LANDING TESTS

Sinking Speed Vs. C.G. Load Factor

S/N 51-7441

Data Request No. L-19-6

L-19A

- Landing Tests
- Drop Tests (Battelle)
- △ Drop Tests (FAMD)

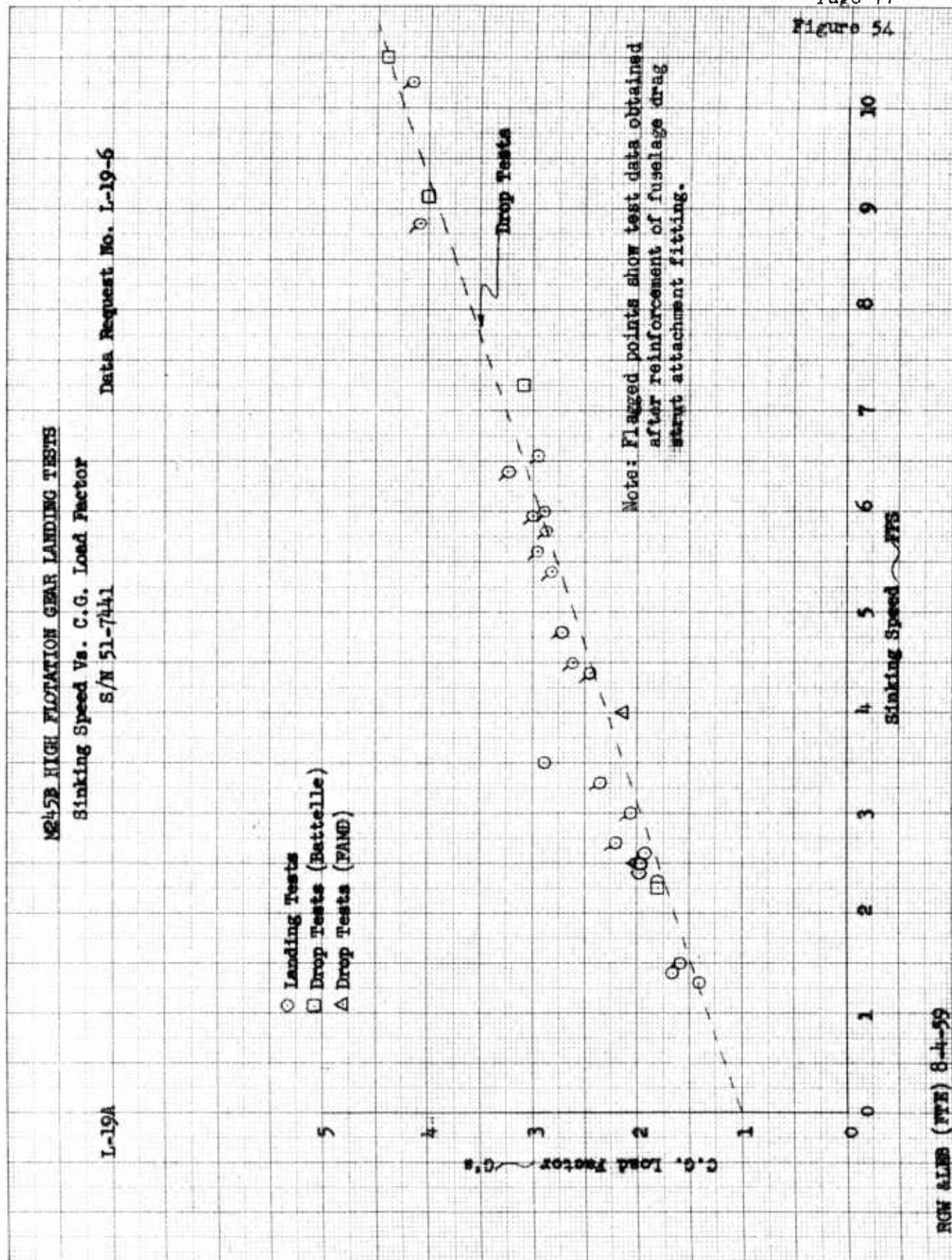
C.G. Load Factor

Drop Tests

Note: Flagged points show test data obtained after reinforcement of fuselage drag strut attachment fitting.

Sinking Speed - FPS

RCW ALLES (NTE) 8-4-59

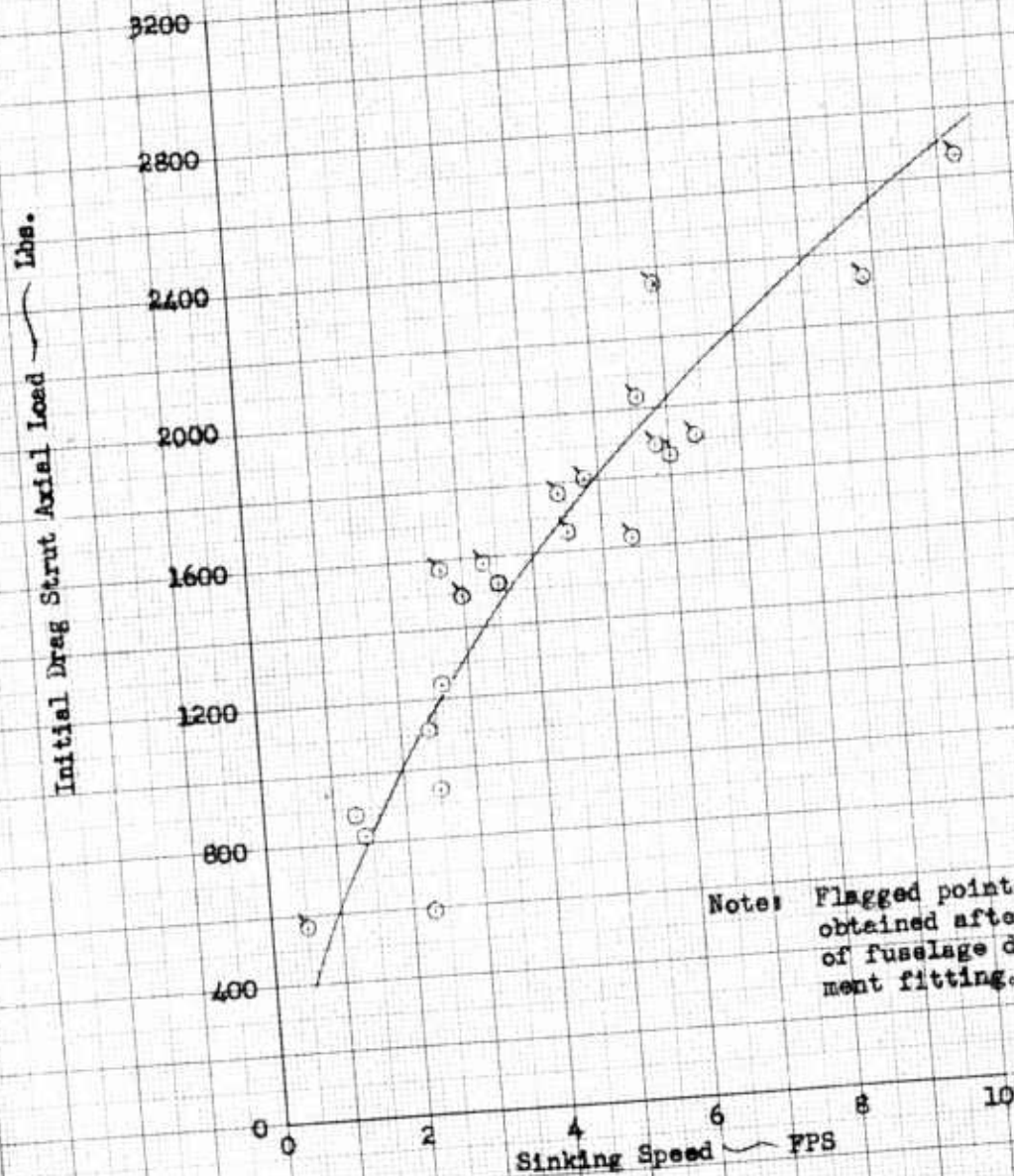


FT245-1

M-245B HIGH FLCTATION GEAR LANDING TESTSSinking Speed Vs. Initial Drag Strut Axial Load
S/N 51-7441

Data Request No. L-19-6B

L-19A



Note: Flagged points show test data obtained after reinforcement of fuselage drag strut attachment fitting.

RGW (FTE) 4-6-60

10 X 10 TO THE CM. 359T-14
KEUFFEL & ESSER CO. AUT. 11.1
SUB. 11.1

Figure 56

M-245B HIGH FLOTATION GEAR LANDING TESTS

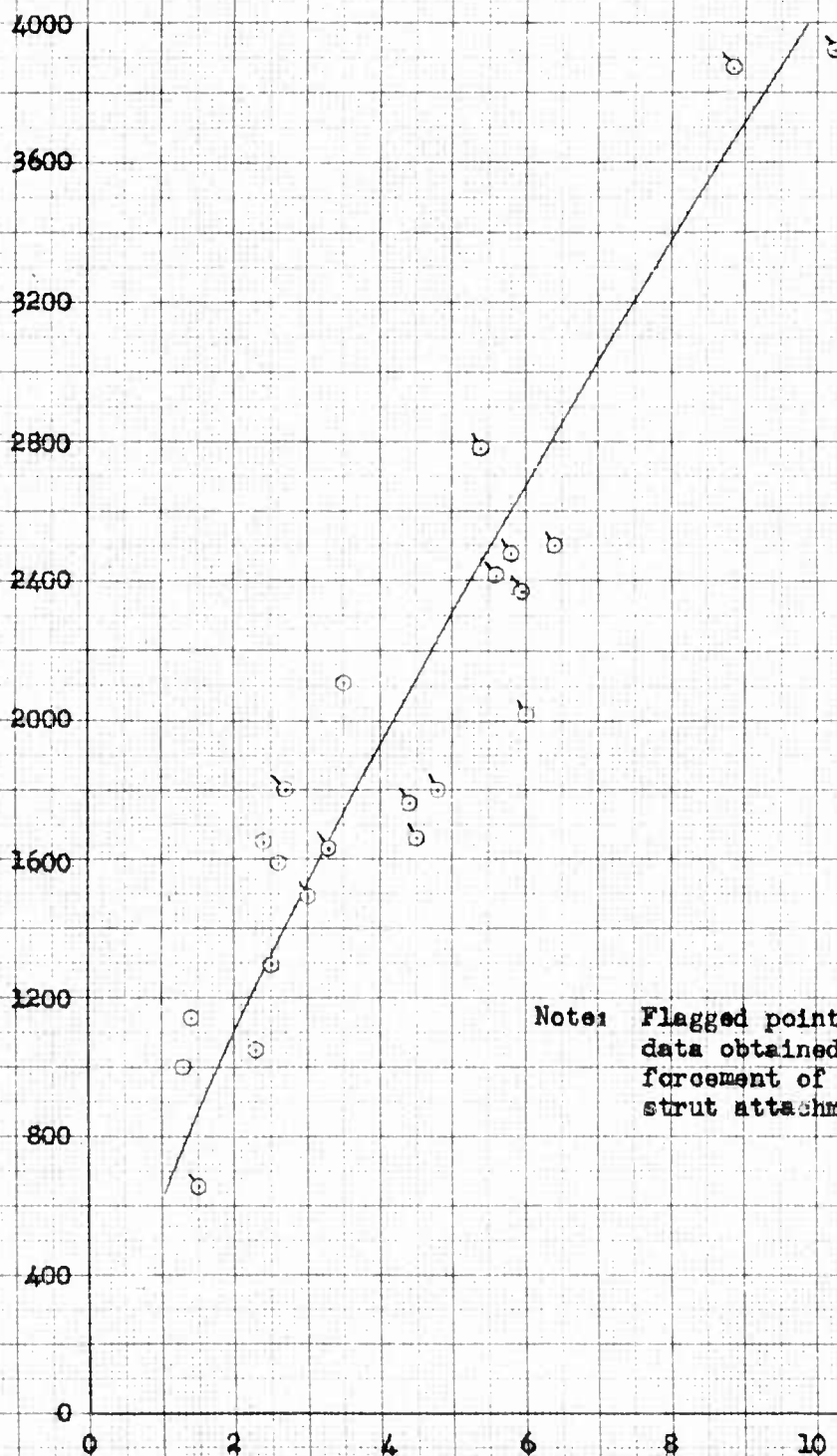
Sinking Speed Vs. Initial Vertical Load

S/N 51-7441

Data Request No. L19-6B

L-19A

Initial Vertical Load ~ lbs.



K-E 10X10 TO THE CM. 359T-14
KEUFFEL & ESSER CO. WILMINGTON, DELAWARE

FT245-1

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Figure 57

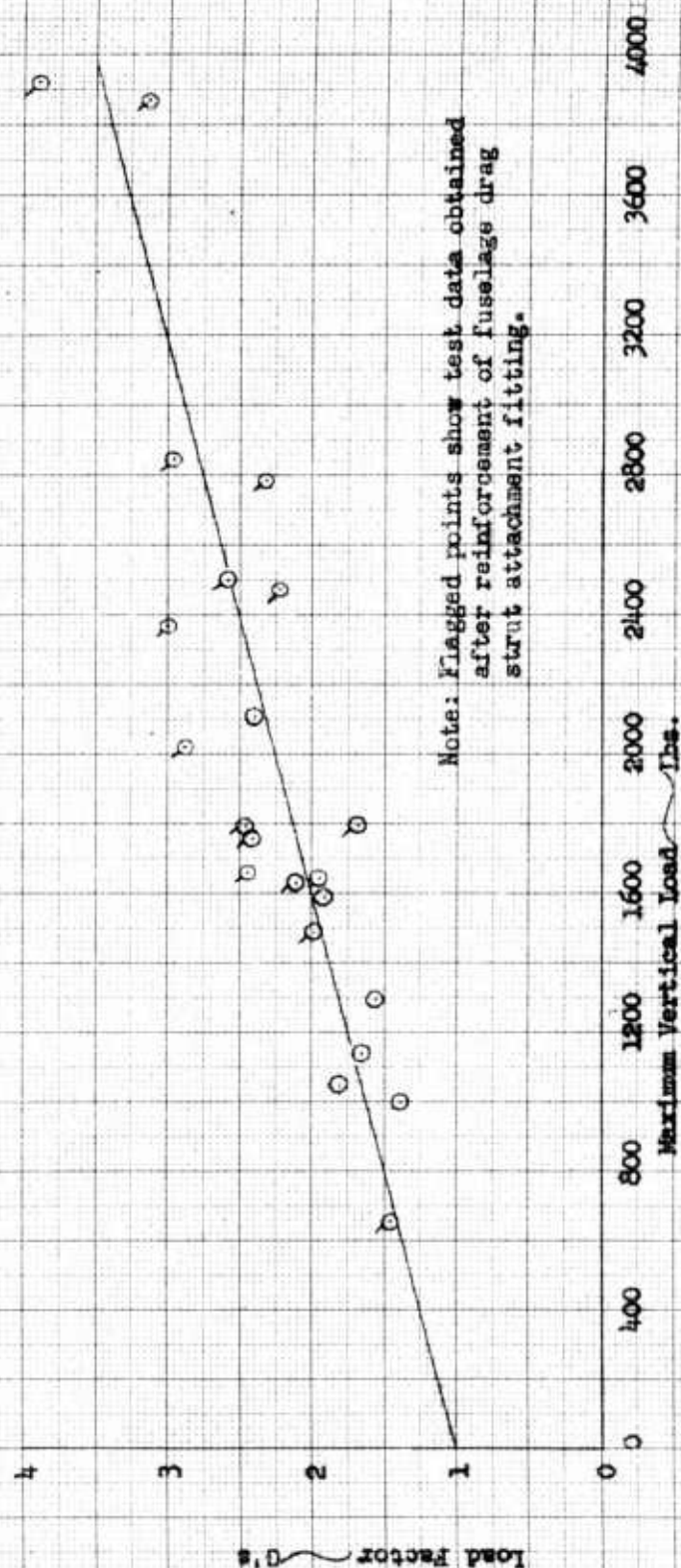
M245B HIGH FLOTATION GEAR LANDING TESTS

Maximum Vertical Load Vs. Simultaneous C.G. Load Factor

S/N 51-7441

Data Request No. L-19-6B

L-19A



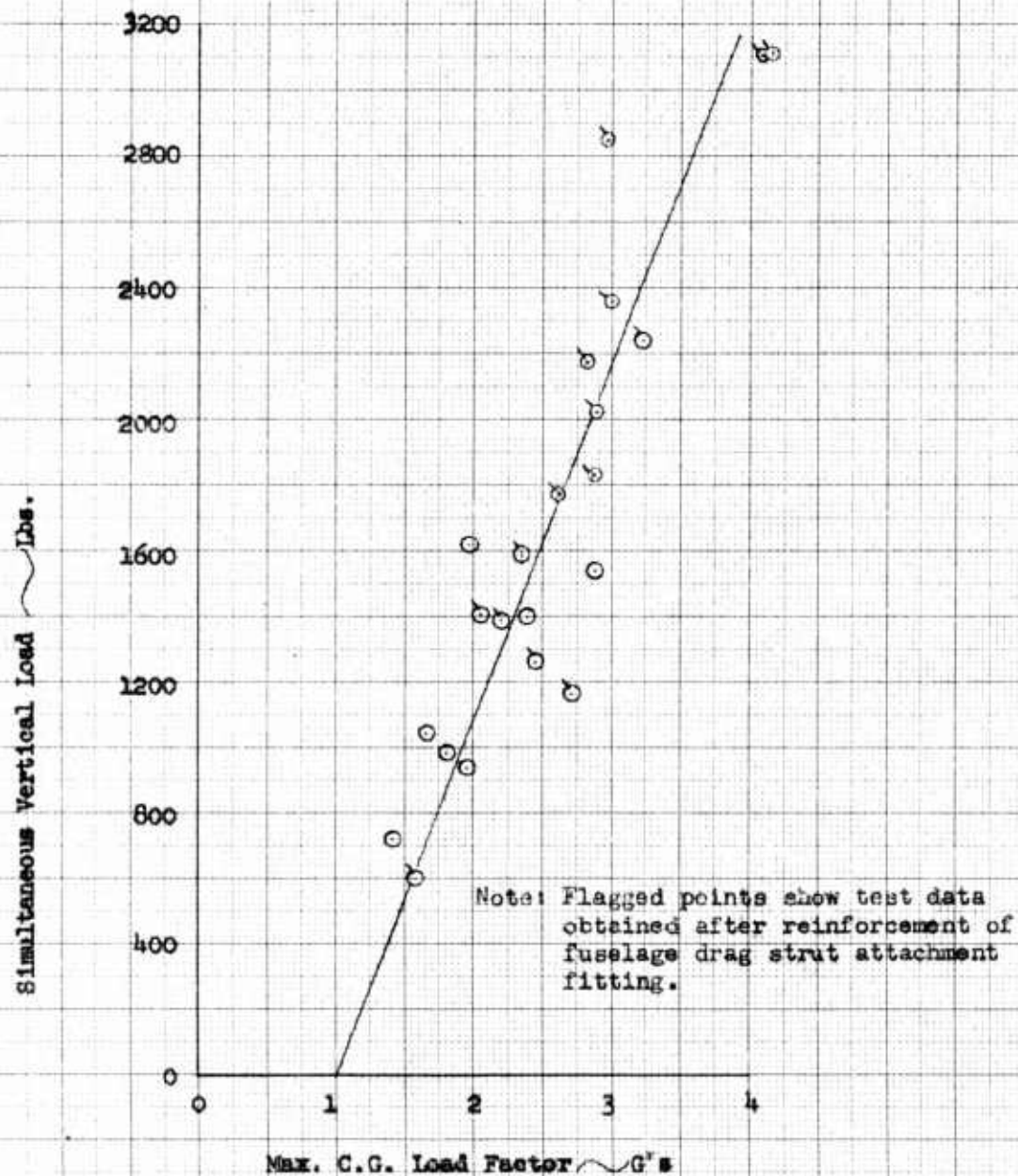
LEB (FTE) 8-4-59

M245B HIGH FLOTATION GEAR LANDING TESTS

Maximum C.G. Load Factor Vs. Simultaneous Vertical Load
S/N 51-7441

Data Request No. L-19-6E

L-19A



10 X 10 TO THE CM 359T-14L
KLEFFEL & ESSER CO. FALL N. J.
ALBANY, N. Y.

M-245 HIGH FLOTATION TIRE LANDING LOAD TIME HISTORY

L-19A Flight No. 19-14
Sinking Speed 3.5 fps
FAT 87°F

July 8, 1959
Data Request No. 119-6

Osc. Rec. No. 24958

Speed
MPH 50
40

Wheel Speed

Tail Wheel Touchdown

Comp. 2000

Right Drag Strut Axial Load

Load
lbs. 1000
-1000

Fea. 2000

Comp. 2000

Left Drag Strut Axial Load

Load
lbs. 1000
-1000

Tens. 2000

1.0

Longitudinal Acceleration

Accel.
G's 0
-1.0

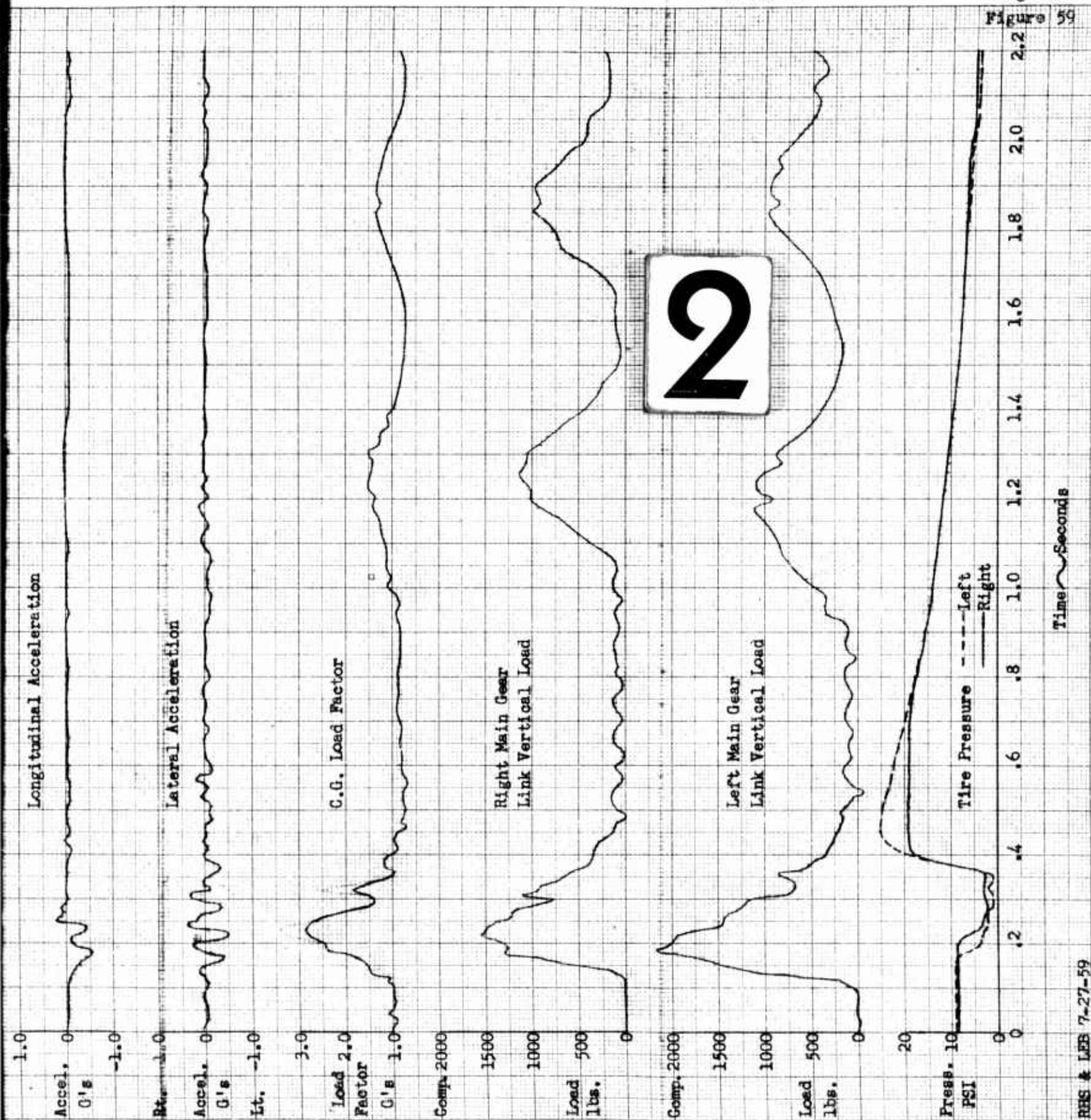
St. 1.0

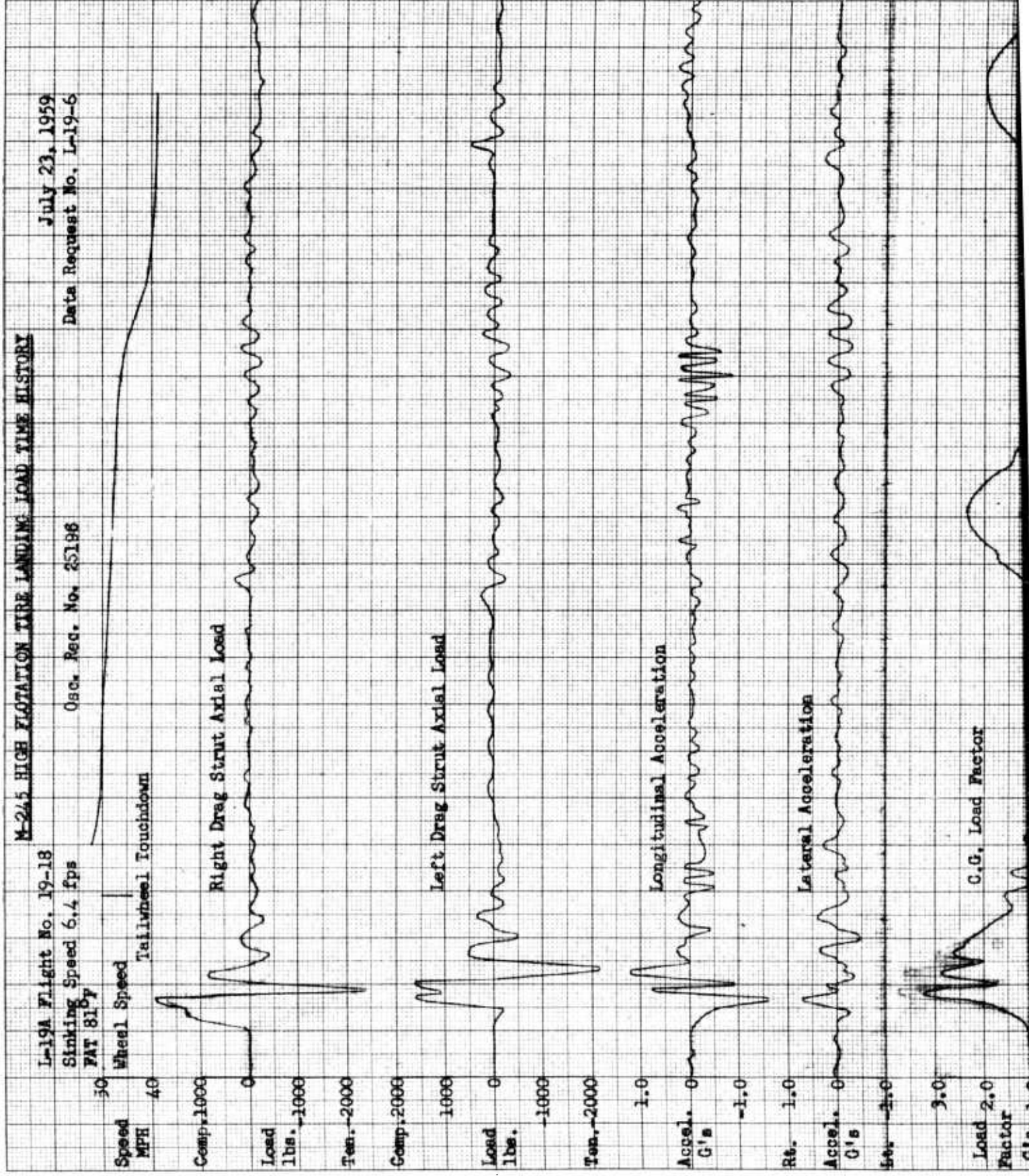
Lateral Acceleration

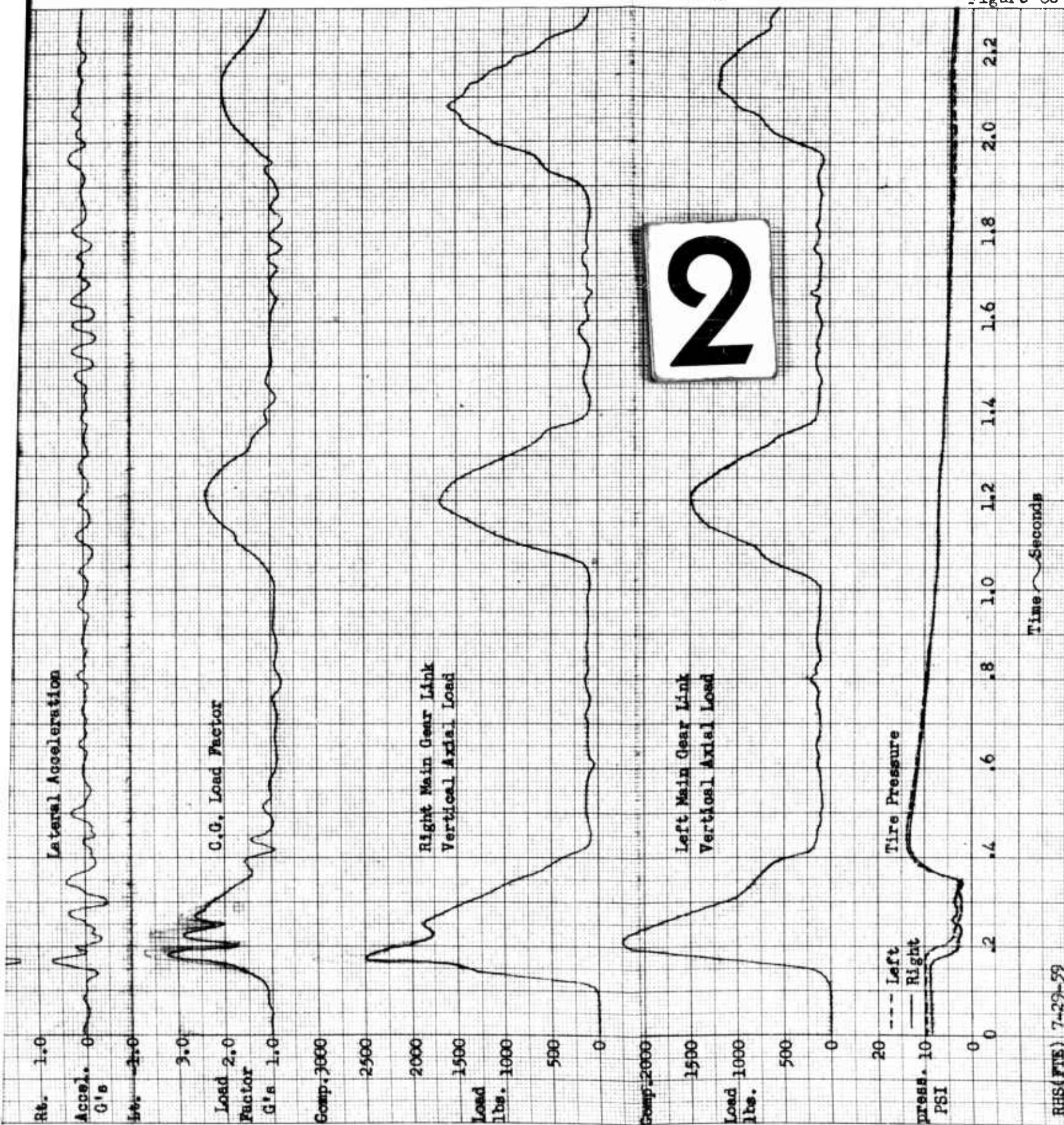
Accel.

1

Figure 59







M-245 10 X 10 TO THE CM. 359T-14L
KUFFEL & ESSER CO. N.Y.C.

1

M-245 HIGH FLOTATION TIRE LANDING LOAD TIME HISTORY

L-19A Flight No. 19-30
Sinking Speed 10.25 FPS

April 4, 1960
FAT 56° F

Ref: Data Request No. L-19-6B
Osc. Record No. 25927

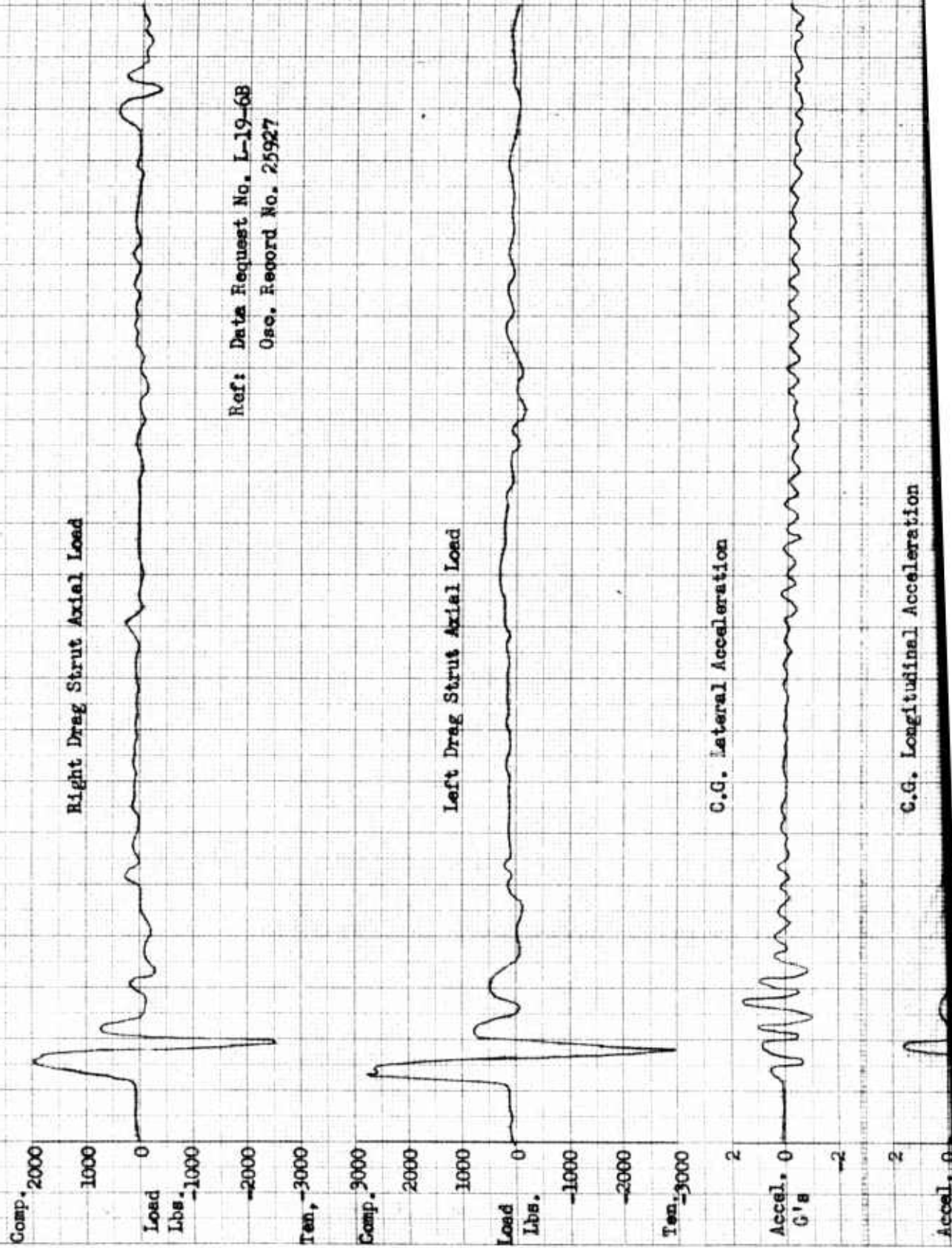


Figure 60A

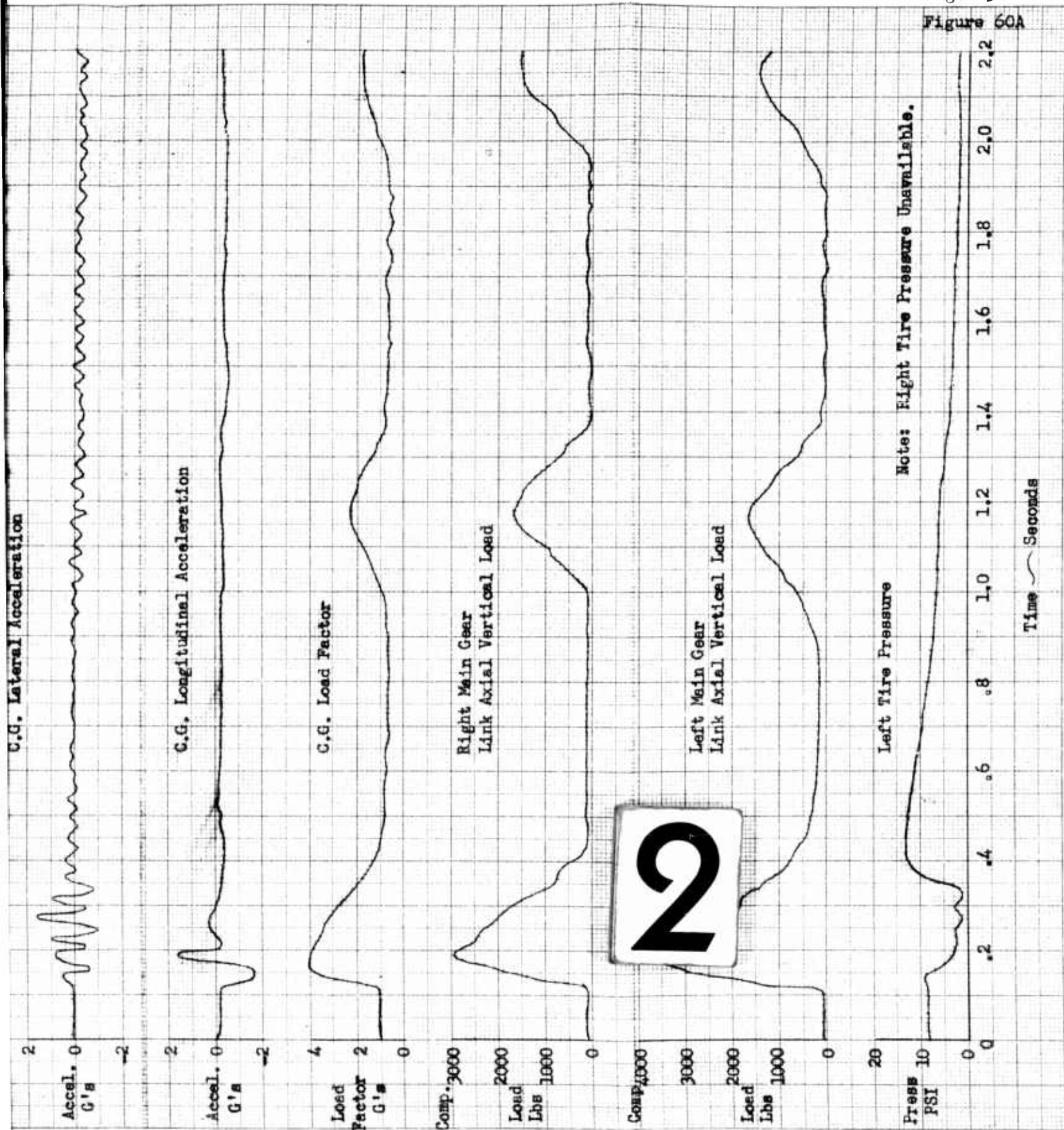


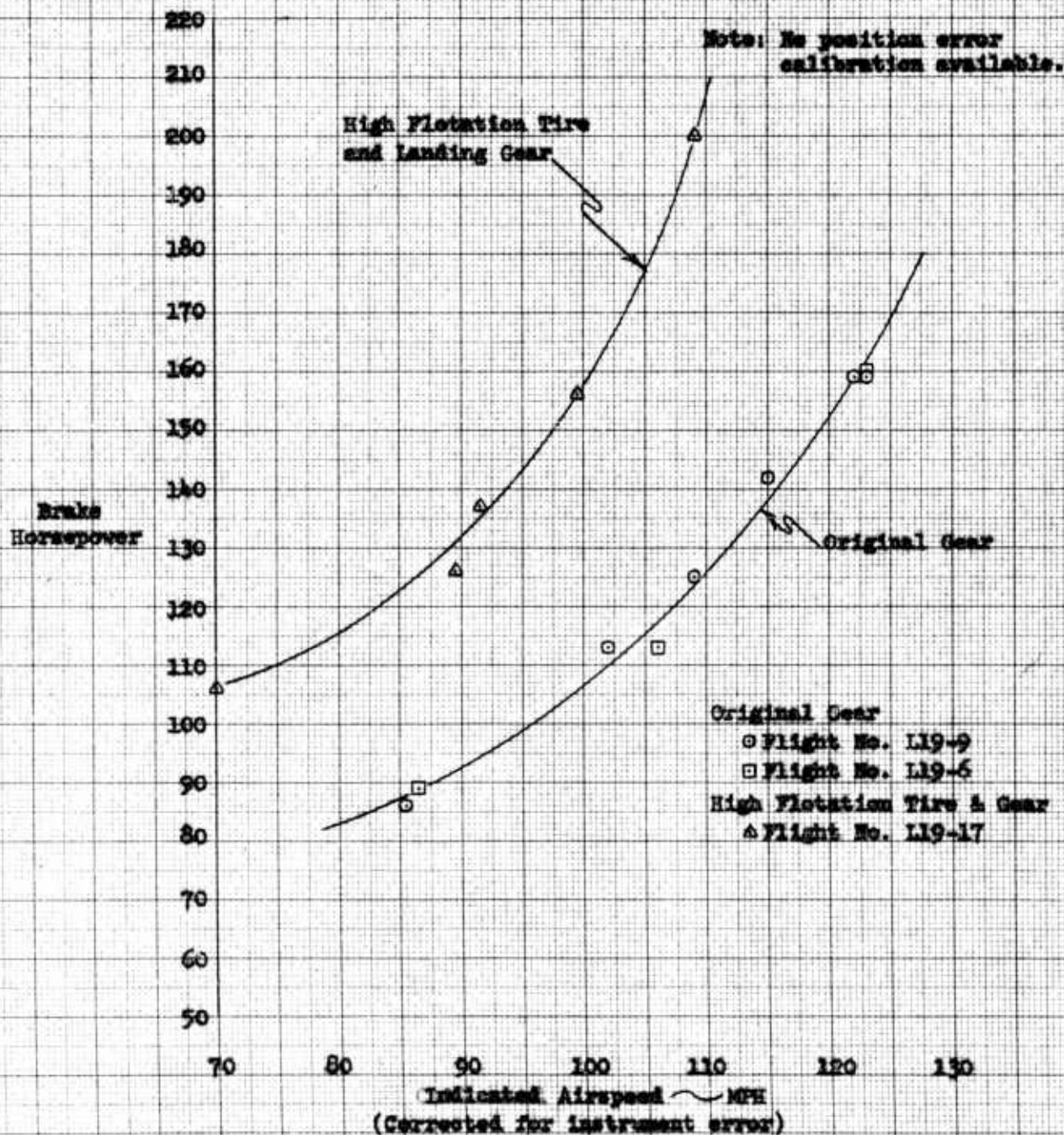
Figure 61

DRAW EFFECT OF HIGH FLOTATION TIRE AND LANDING GEAR
(Speed-Power)

L-19A

S/N 31-7441

Data Request No. L-19-3
and L-19-7



JEG (FIE) 7-27-59

K-E
10X10 TO THE CM.
NEUFFEL & ESER CO.
ALBANY, N.Y.

359T-14

K-Σ 10X10 TO THE CM 359T-1-1
KEUFFEL & ESSER CO.
ALBANY, N. Y.

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Figure 62

L-19A TAKE-OFF PERFORMANCE - ORIGINAL GEAR

Flight No. L-19-7, L-19-8 S/N 51-7441 May 4, 1959

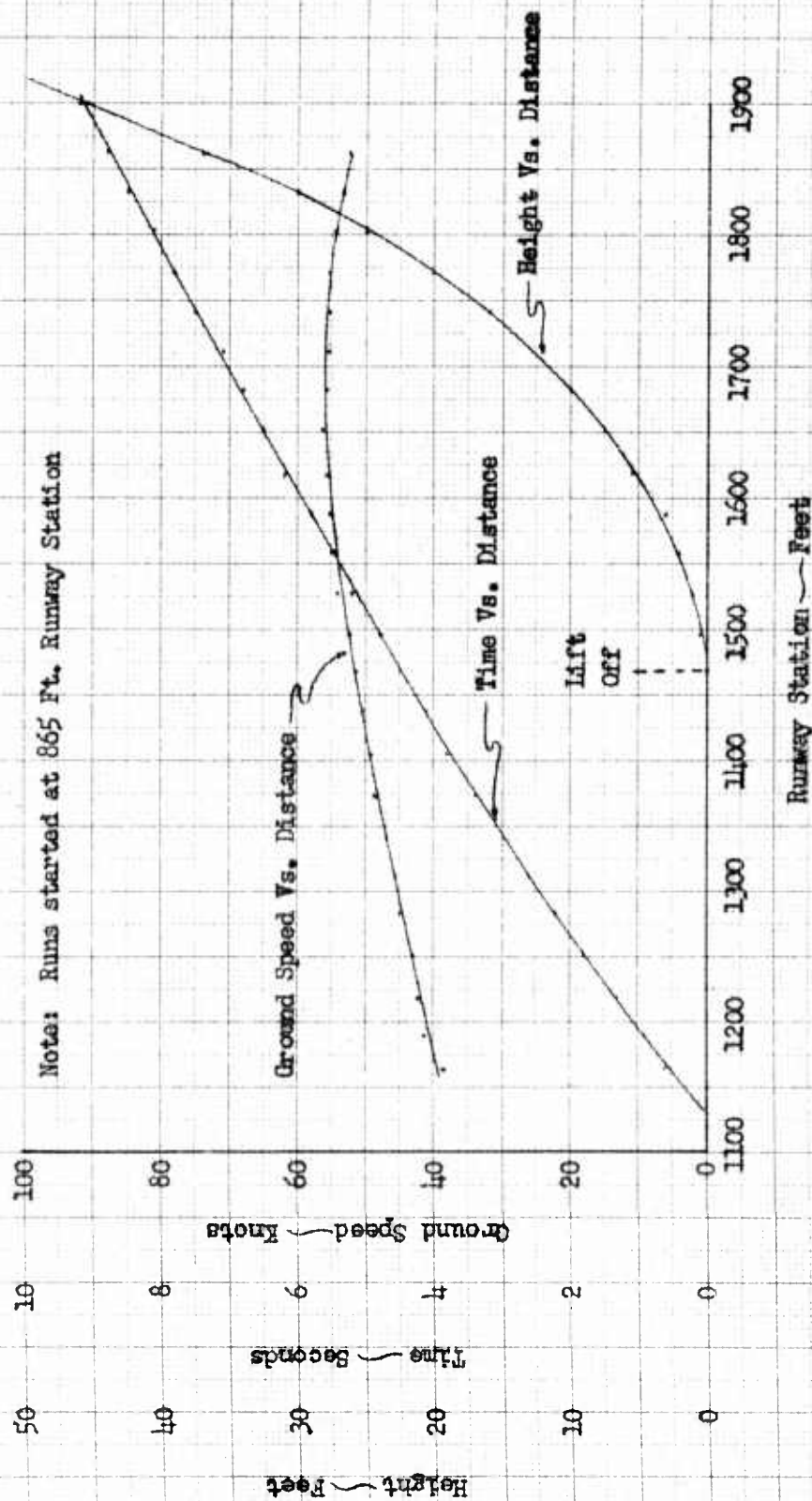
Data Source: Photo Theodolite Data Request L-19-4

BHP 184

Run No. 9

Gr. Wt. 2400 lbs
Wind Calm

Flaps 30°
F.A.T. 22° C



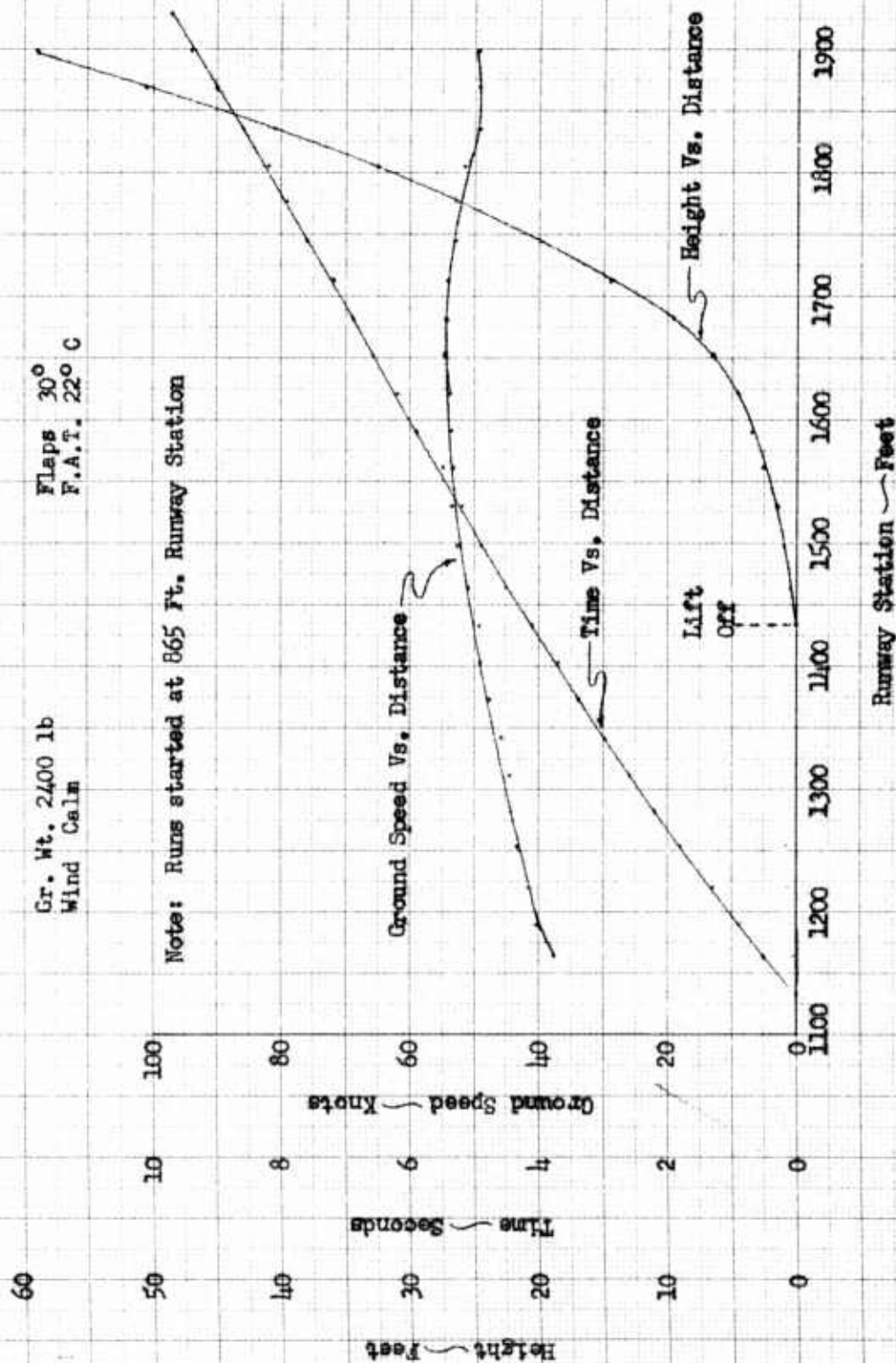
RCW 4/21/59

Figure 63

L-19A TAKE-OFF PERFORMANCE - ORIGINAL GEAR
Flight No. L-19-7, L-19-8 S/N 51-7441 May 4, 1959
Data Source: Photo Theodolite Data Request L-19-4
BHP 185
Run No. 10

Gr. Wt. 2400 lb
Wind Calm
Flaps 30°
F.A.T. 22° C

Note: Runs started at 865 Ft. Runway Station



RCW 4/21/59

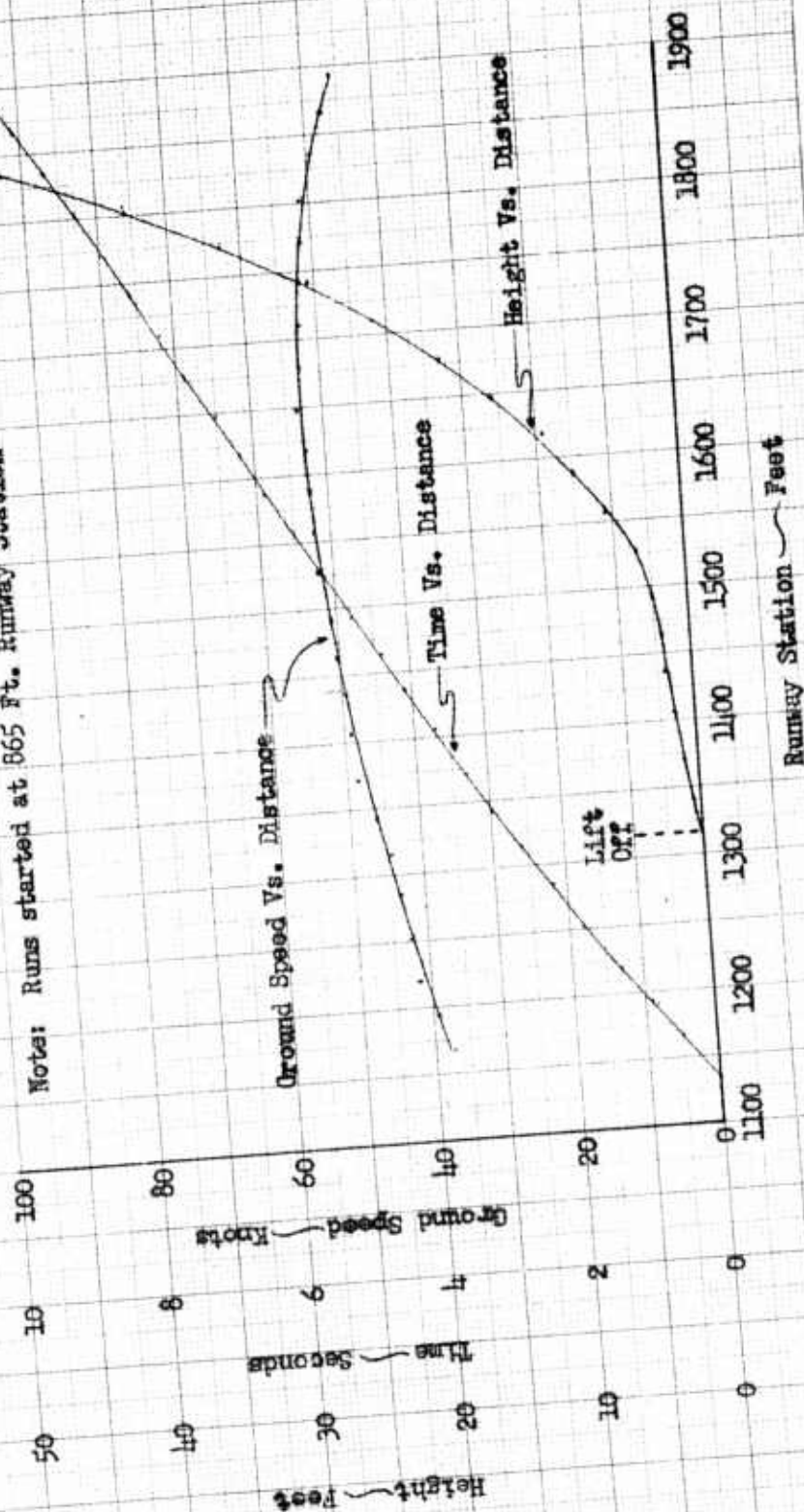
10X10 TO THE CAP
KEUFFEL & ESSER CO.
ALBANY, N.Y.

FT245-2

L-19A TAKE-OFF PERFORMANCE - ORIGINAL GEAR
Flight No. L-19-7, L-19-8 S/N 51-7441 May 4, 1959
 Data Request L-19-4
 Data Source: Photo Theodolite
 Run No. 11

Gr. Wt. 2400 lb
 Wind 2 MPH
 Flaps 30°
 P.A.T. 22° C

Notes: Runs started at 865 Ft. Runway Station



ROW 4/21/59

L-19A TAKE-OFF PERFORMANCE - HIGH FLOTATION GEAR

July 23, 1959

S/N 51-7441

Flight No. L-19-18

Data Request L-19-8

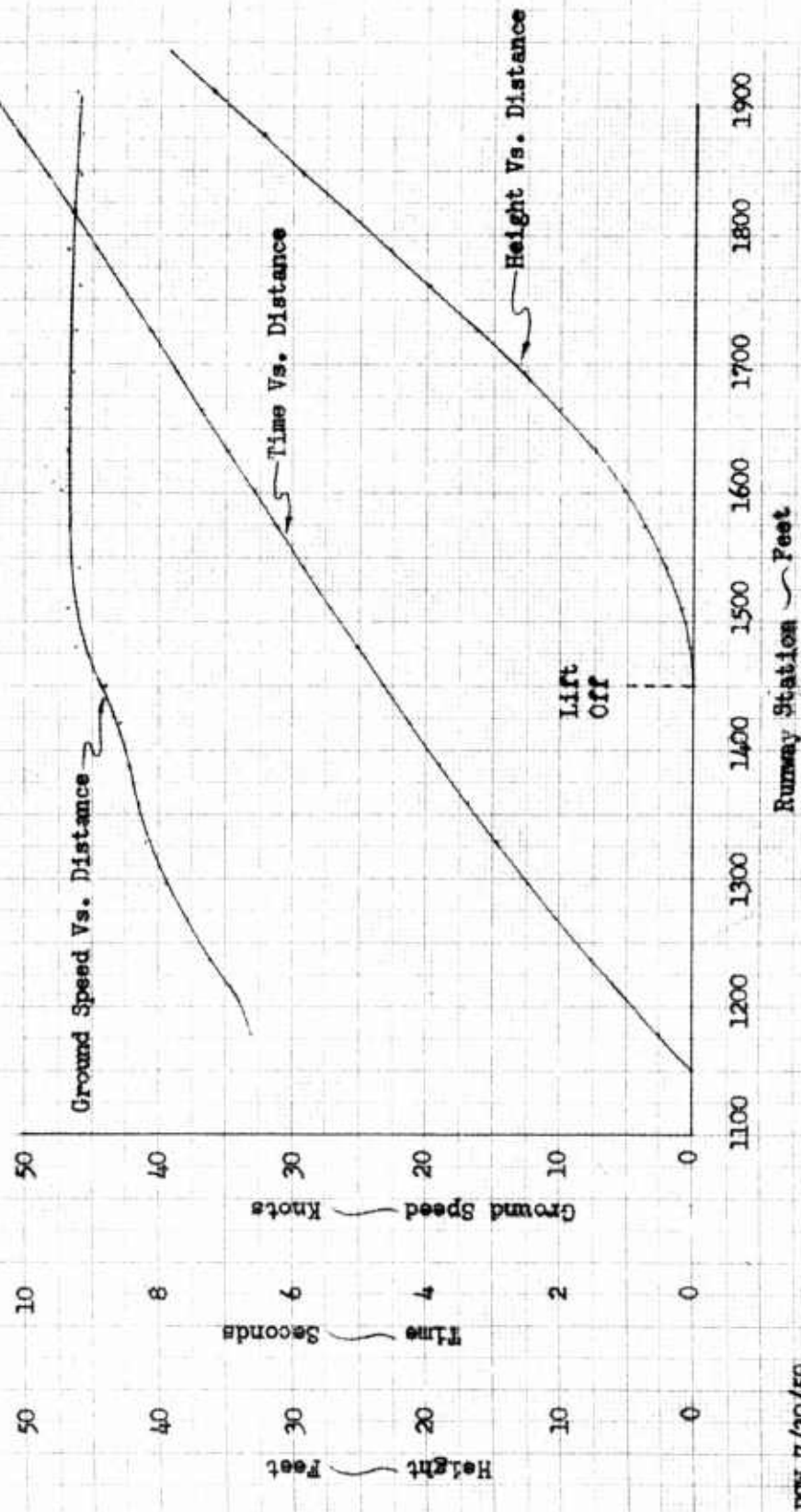
Data Source: Photo Theodolite

Run No. 1

Flaps 30°
P.A.T. 27° C

Gr. Wt. 2400 lbs
Wind 1.4 mph

Note: Runs started at 970 Ft. Runway Station



HCN 7/30/59

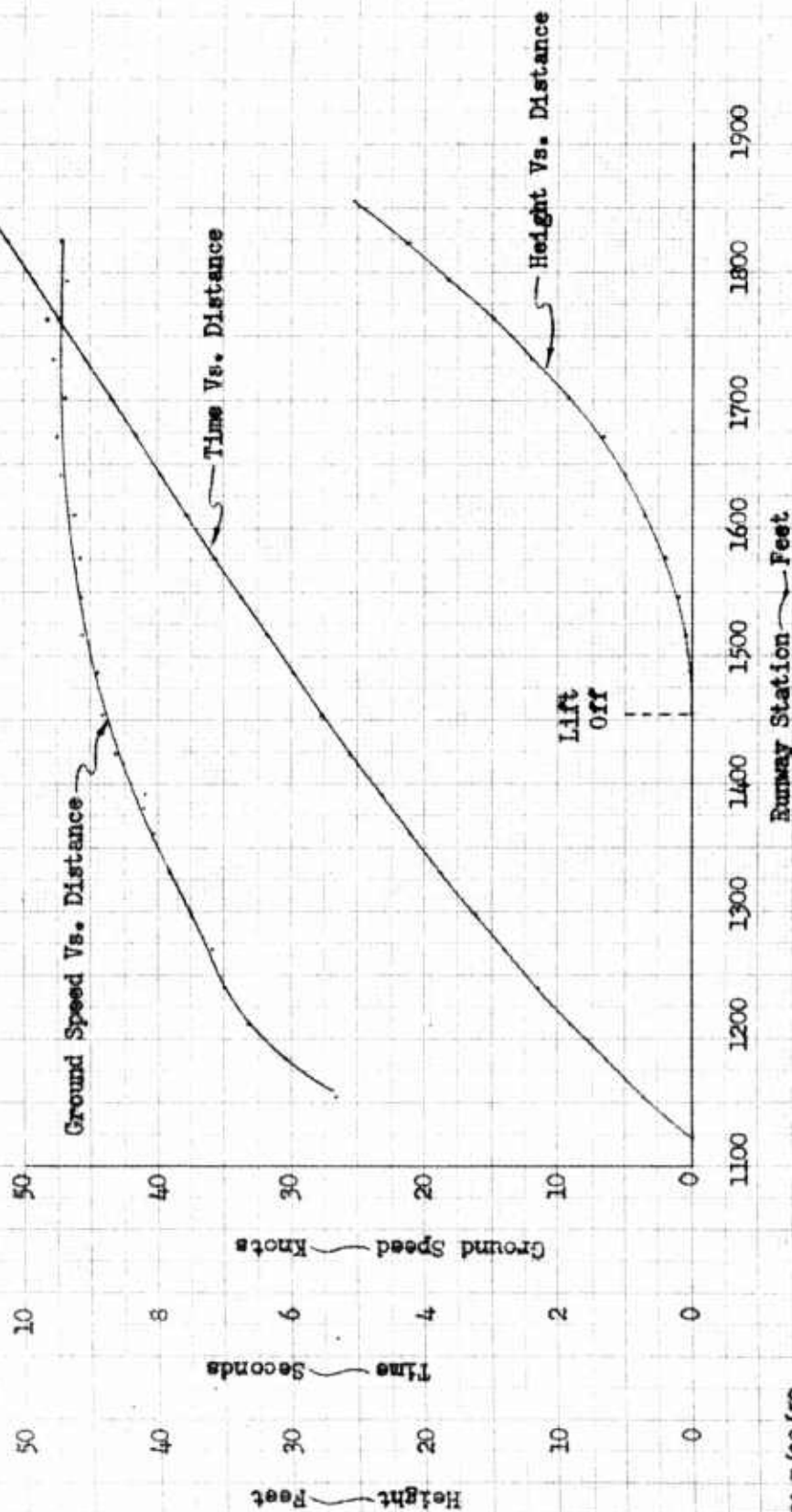
L-19A TAKE-OFF PERFORMANCE - HIGH FLOTATION GEAR

Flight No. L-19-18 S/N 51-7441 July 23, 1959
Data Source: Photo Theodolite Data Request L-19-8

Gr. Wt. 2400 lbs Flaps 30°
Wind 1.8 mph P.A.T. 280 C

Run No. 5

Note: Run started at 970 Ft. Runway Station



REV 7/30/59

| | | | | | |
|--|---------------|---|------------|------------------------------|---------|
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| | | OF FAIRCHILD ENGINE & AIRPLANE CORPORATION | | | |
| MODEL | M-245B | PREPARED BY | CHECKED BY | APPROVED BY | |
| SUBJECT:- INITIAL FLIGHT TESTS, HIGH FLOTATION LANDING GEAR | | | | DATE January 22, 1960 | |
| | | | | REVISED | |

TABLE I
L-19A COMPARATIVE PERFORMANCE DATA
Take-off

Data Request No. L19-8

| ITEM | RUN NO. | | | | |
|-------------------------------------|------------------------------------|-------|-------|----------------------------------|-------|
| | Original Landing Gear
30° Flaps | | | High Flotation Gear
30° Flaps | |
| | 9 | 10 | 11 | 1 | 5 |
| Gross Weight (lbs) | 2400 | 2400 | 2400 | 2400 | 2400 |
| C.G. Location (% m.a.c.) | 33.6 | 33.6 | 33.6 | 29.8 | 29.8 |
| Head-wind (mph) | 0 | 0 | 2.0 | 1.4 | 1.8 |
| F.A.T. (°C) | 22.0 | 22.0 | 22.0 | 27.5 | 28.5 |
| Pressure Altitude (feet) | 510 | 510 | 510 | 490 | 490 |
| Ground Speed at lift-off (mph) | 58.1 | 56.4 | 52.6 | 50.9 | 50.8 |
| Lift-off Speed (kts, V_0) | 56.7 | 55.0 | 53.4 | 50.5 | 51.0 |
| Observed Ground Dist. (feet) | 605 | 570 | 450 | 480 | 485 |
| Observed Air Dist. to 50' (feet) | 450 | 435 | 535 | 595 | 595 |
| Observed Total Dist. (feet) | 1055 | 1005 | 985 | 1075 | 1080 |
| Manual Scheduled Lift-off V_0 | 53 | 53 | 53 | 53 | 53 |
| Manual Ground Dist. (feet) | 610 | 610 | 580 | 650 | 660 |
| Manual Air Dist to 50' (feet) | 410 | 410 | 420 | 450 | 460 |
| Manual Total Dist (feet) | 1020 | 1020 | 1000 | 1100 | 1120 |
| Observed Total Dist/Man. Total Dist | 1.034 | 0.985 | 0.985 | 0.977 | 0.964 |
| Reference Figure No. | 62 | 63 | 64 | 65 | 66 |

| | | | | | |
|--|--|---|----------------------------------|-------|---------|
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| MODEL M-245B | PREPARED BY | CHECKED BY | APPROVED BY | | |
| SUBJECT:- INITIAL FLIGHT TESTS, HIGH FLOTATION LANDING GEAR | | | DATE January 22, 1960
REVISED | | |
| <p align="center"><u>TABLE IIB</u>
<u>LOG OF TESTS</u> (cont'd)</p> <p align="center">M-245B High Flotation Landing Gear Installed
with Simplified Inflation System</p> <p align="center">L-19A</p> <p align="right">Serial No. Army 51-7441
Pilot: R. V. Ford</p> | | | | | |
| Ground Test No.
and Date | Purpose | Remarks | | | |
| -
5-21-59 | Functional checks of inflation system. | Inflation system adequate for ground tests. No data. | | | |
| 1
5-22-59 | 2-inch obstacles at 10-40 mph tire pressure 4 and 6.5 psi. | Satisfactory data obtained. Twin obstacles endanger tailwheel. | | | |
| 2
5-25-59 | 2-inch obstacle, 10-30 mph at 3.7 and 5.0 psi tire pressure. | Data indicated that obstacle tests at 5.0 psi may exceed drag load limits at higher speeds. | | | |
| 3
5-25-59 | Rechecks of above with reduced attenuation. | Satisfactory data obtained. Drag loads near limits. | | | |
| 4
5-27-59 | Rolling characteristics over ditch at 5-25 mph and 4.9 psi tire pressure. Taxi check at 2.7 psi tire pressure. | No heat buildup. Some wrinkles at slow speeds. No wrinkles observed at 35 mph. | | | |
| 5
5-27-59 | Obstacles 4" and 2", 10-25 mph 2.7 psi tire pressure. | Data satisfactory. | | | |
| 6
5-28-59 | Taxi runs. 6" obstacles. 2.7 psi tire pressure. Up to 27 mph calibrated wheel speed. | " " | | | |
| 7
6-3-59 | 8 inch obstacles; 4" deep ditch 2.7 psi tire press, 10-30 mph | " " | | | |
| 8
6-3-59 | 8" obstacles; slow speeds, 6" deep ditch, 2.7 psi | " " | | | |
| 9
6-4-59 | 6 3/8" and 8" obstacles; 4" and 6" deep ditches. Up to 36.0 mph | " " | | | |
| 10
6-4-59 | Obstacles 4 1/4", 6 3/8". 8-10 mph and 6" deep ditch 25-30 mph | " " | | | |

| | | | | | |
|--|--|--|--|------------------------------|---------|
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| MODEL
M-245B | PREPARED BY | CHECKED BY | | APPROVED BY | |
| SUBJECT:- INITIAL FLIGHT TESTS, HIGH FLOTATION LANDING GEAR | | | | DATE January 22, 1960 | |
| | | | | REVISED | |
| <p>TABLE IIB - continued</p> <p>LOG OF TESTS (continued)</p> <p>M-245B High Flotation Landing Gear Installed
with Simplified Inflation System</p> <p>L-19A Serial No. Army 51-7441
 Pilot: R. V. Ford</p> | | | | | |
| Ground Test No.
and Date | Purpose | Remarks | | | |
| 11
6-5-59 | Ditch 4" and 8" deep; 2.7 psi tire pressure. Obstacles 2 1/8" and 4 1/4". | Data satisfactory. | | | |
| 12
6-8-59 | 4 1/4" obstacle at 2.7 and 3.7 psi tire pressure. Ditch 6" and 8" deep; 2.7 psi tire pressure. | " " | | | |

| | | | | | |
|--|--|---|--|------------------------------|----------------|
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| MODEL M-245B | | OF FAIRCHILD ENGINE & AIRPLANE CORPORATION | | | |
| PREPARED BY | | CHECKED BY | | APPROVED BY | |
| SUBJECT:- INITIAL FLIGHT TESTS, HIGH FLOTATION LANDING GEAR | | | | DATE January 22, 1960 | |
| | | | | REVISED | |

TABLE IIC
LOG OF TESTS

M-245B HIGH FLOTATION LANDING GEAR

L-19A

Serial No. Army 51-7441
Pilot: R. V. Ford

| Flight No.
Date and
Duration | Purpose | Remarks |
|------------------------------------|--|--|
| 10*
7-1-59
15 min. | Functional tests of flight inflation system with quick reinflation. | Power-off stalls normal with T,θ. and landing flap. On landing good shock absorption and quick reinflation gave smooth roll-out. Oil temperature reached limits. |
| 11
7-6-59
15 min. | Landing tests.
Quick reinflation to 5 psi. | Control satisfactory on lift-off and landings. Power-on stalls (2300 rpm) normal. |
| 12
7-7-59
10 min. | Landing tests. | Late exhaust on right gear. Some directional difficulty believed due to tail wheel shimmy. |
| 13
7-7-59
5 min. | Demonstration landing.
Wing camera installed. | Tail wheel assembly bolts tightened and improvement resulted in tail wheel shimmy. |
| 14
7-8-59
20 min. | Heavy landing for directional check and tire characteristics. | Satisfactory data obtained. No difficulty with tail. |
| 15
7-21-59
10 min. | Demonstration. Increased speeds on obstacles and ditch. | Drag strut reinforcement installed. Tail spring satisfactory. Left tire wearing considerably where sidewalls contact ground at low pressure. |
| 16
7-22-59
10 min. | Demonstration for AF and Army. Landings, ditch and obstacles. Increased landing loads. | Time history of one landing made. Approximately 4-inch bounce with 3 fps sinking speed. |
| 17
7-23-59
25 min. | Speed power | Five speed power points obtained. Oil temperature 7° C over the 108° limit. |
| 18
7-23-59
45 min. | Performance take-off
Taxi in soft soil and mud. | Time history of one landing, 6-4 fps. (Figure 60) |

* Note that first nine flights were with standard L-19 landing gear (Table IIA)

| | | | | | |
|--|-------------|---|---|-------|----------------|
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| SUBJECT:- <u>INITIAL FLIGHT TESTS, HIGH FLOTATION LANDING GEAR</u> | | | DATE <u>January 22, 1960</u>
REVISED <u>April 14, 1960</u> | | |

TABLE IIC - continued
LOG OF TESTS
M-245B HIGH FLOTATION LANDING GEAR

| Flight No.
Date and
Duration | Purpose | Remarks |
|------------------------------------|---|--|
| 19
7-24-59
5 min. | Demonstration landing on runway. | |
| 20
7-24-59
5 min. | Taxi on soft soil and mud. | Tires throw mud into propeller. No problem in soft dry soil. Taxied over mud where 4-wheel drive jeep stalled. |
| 21
7-27-59
25 min. | Improved technique in landing. Check landing without quick-reinflation. | Nose high power approach with 60° flaps gives better rate of descent control. |
| 22
7-28-59
10 min. | Landing checks without quick reinflation. | No notable change in bounce even with 3 point landing. |
| 23
7-28-59
10 min. | Demonstration for Marines. | Landing, obstacles 6 3/8 and 8 inch, ditches 24 x 6 and 24 x 8 inch. |
| 24
7-28-59
20 min. | Rough sod landing. | No problem with minor obstacles but wide ditch produced bad bounce during taxi, 15-20 mph. |
| 25
7-29-59
15 min. | Demonstration. | Quick reinflation disconnected. (Same as Flight 23.) |
| 26
3-29-60
5 min. | Post periodic inspection test flight. | Flight terminated early due to smoke in cockpit. Attributed to hot oil in windshield defroster duct. |
| 27
3-29-60
10 min. | Instrumentation check-out. High rate of descent landings. | Quick reinflation connected. Noticeable bounce on each of two landings. |

| | | | | | |
|--|--------------------------------|--|--|-------------------------------|---------|
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| MODEL M-245B | | OF FAIRCHILD ENGINE & AIRPLANE CORPORATION | | | |
| PREPARED BY | | CHECKED BY | | APPROVED BY | |
| SUBJECT:- <u>INITIAL FLIGHT TESTS, HIGH FLOTATION LANDING GEAR</u> | | | | DATE <u>January 22, 1960</u> | |
| | | | | REVISED <u>April 14, 1960</u> | |
| <p align="center"><u>TABLE IIC - continued</u></p> <p align="center"><u>LOG OF TESTS</u></p> <p align="center"><u>M-245B HIGH FLOTATION LANDING GEAR</u></p> | | | | | |
| Flight No:
Date and
Duration | Purpose | Remarks | | | |
| 28
4-1-60
30 min. | High rate of descent landings. | Quick reinflation connected.
Four landings accomplished.
8.85 fps max. sinking speed.
Airplane inspected - no damage. | | | |
| 29
4-1-60
15 min. | High rate of descent landings. | Quick reinflation connected.
Three landings accomplished.
5.95 fps max. sinking speed. | | | |
| 30
4-4-60
10 min. | High rate of descent landings. | Quick reinflation connected.
Two landings accomplished.
10.25 fps max. sinking speed.
Airplane inspected - no damage. | | | |
| <p align="center">Total flight time of L-19A with M-245B gear = 5 hours 15 minutes.</p> <p>Note: In addition to these tests, three flights were made for in-flight folding tests of the tire using a C-119G airplane, AF S/N 53-3136.</p> <p align="center"> July 31, 1959 1135-1210 (0+45)
 August 3, 1959 1425-1455 (0+30)
 March 23, 1960 1440-1520 (0+40) </p> <p>On the first flight a tire patch over an internal bungee attachment point blistered severely at altitude and tests with the tire lowered into the slipstream were not considered advisable. The patch was replaced and a second flight was flown during which an attempt to fold the tire at 85 knots was unsuccessful. The tire was modified and successful folding was achieved on the third flight.</p> | | | | | |



Photo 35-182

M-245B gear crossing ditch 24 inches wide,
8 inches deep, at 10-15 mph. Tire pressure
is 3 psi.

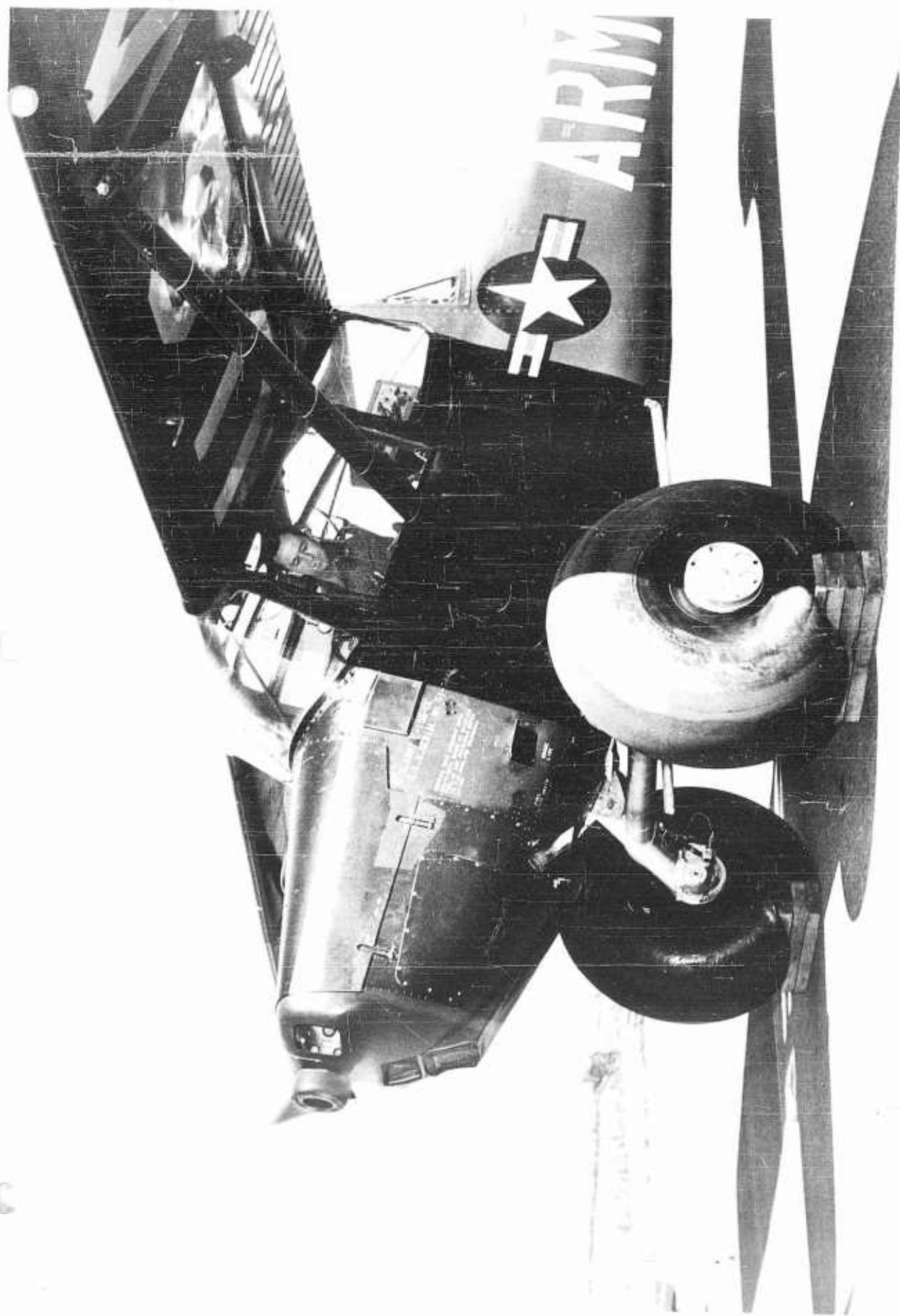


Photo 35-388

M-245B gear crossing 6 3/8 inch and 8 inch
obstacles at approximately 8 mph. Tire
pressure 2.7 psi.

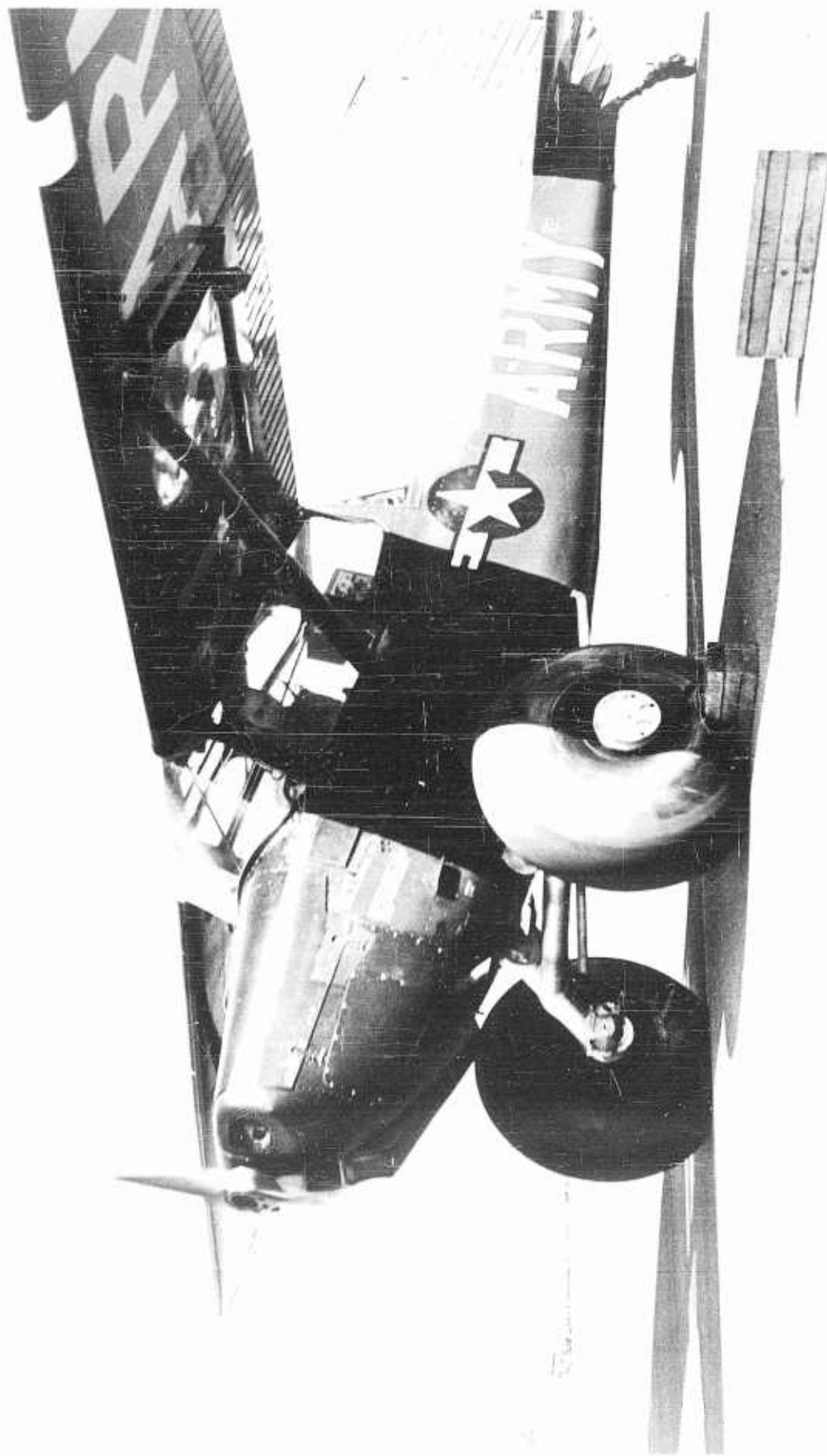


Photo 35-390

M-245B gear crossing 6-3/8 inch obstacle.
With 2.7 psi tire pressure this obstacle
was negotiated at speeds to 38 mph.

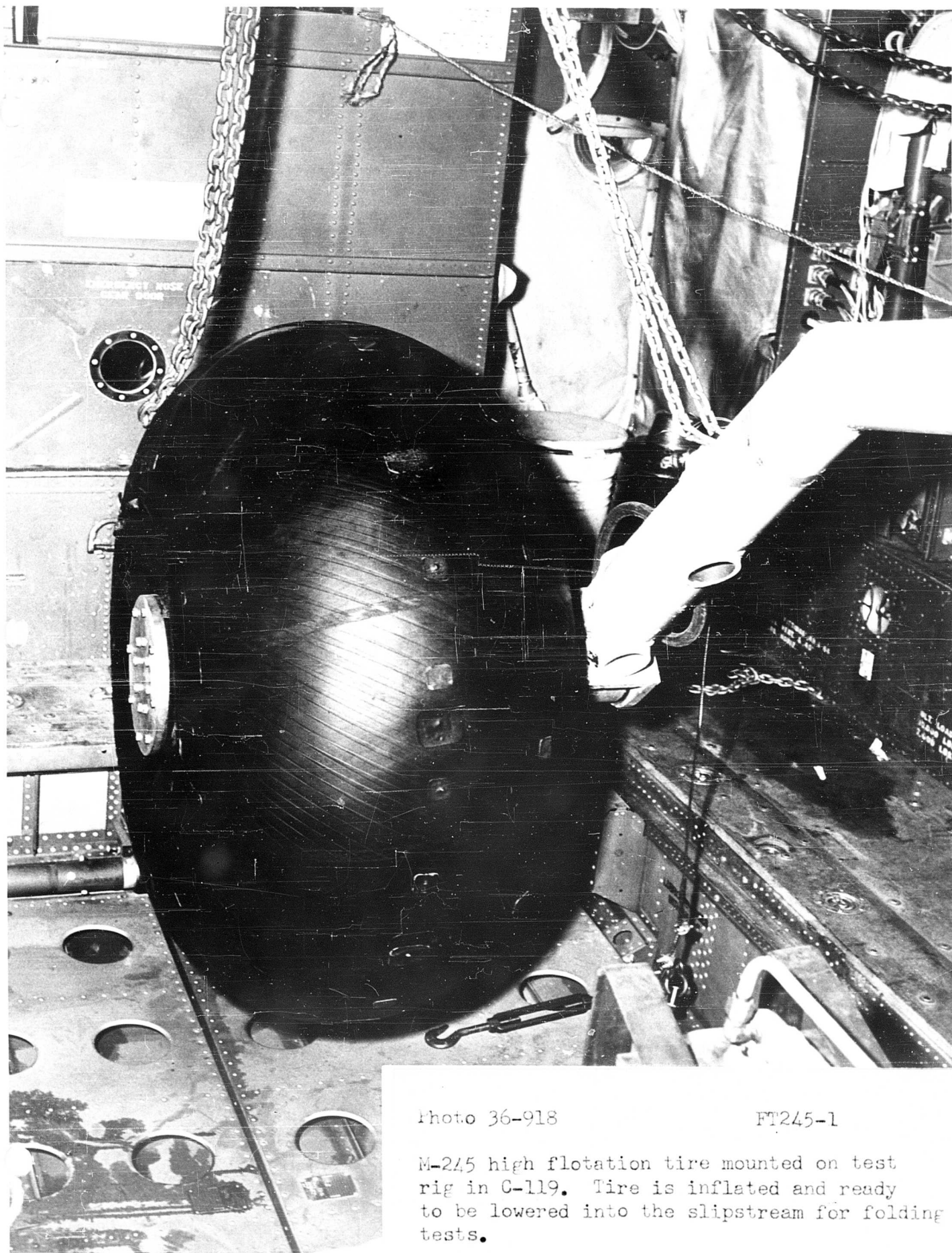


Photo 36-918

FT245-1

M-245 high flotation tire mounted on test rig in C-119. Tire is inflated and ready to be lowered into the slipstream for folding tests.

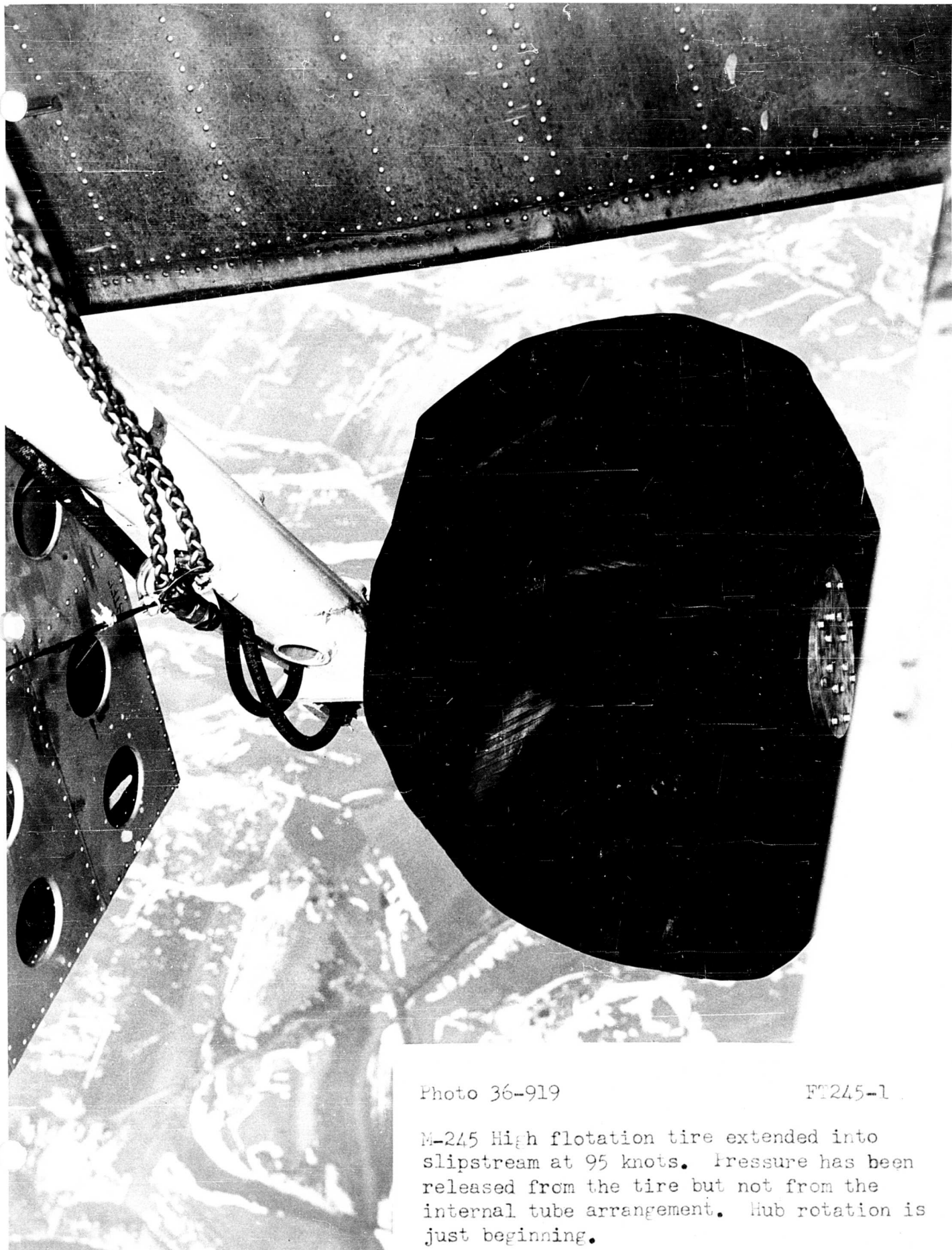


Photo 36-919

FT245-1

M-245 High flotation tire extended into slipstream at 95 knots. Pressure has been released from the tire but not from the internal tube arrangement. Hub rotation is just beginning.



Photo 36-920 .

FT245-1

M-245 high flotation tire during folding cycle. Hub rotation has begun. Tire pressure is depleted and pressure remains in the internal diagonal tubes.

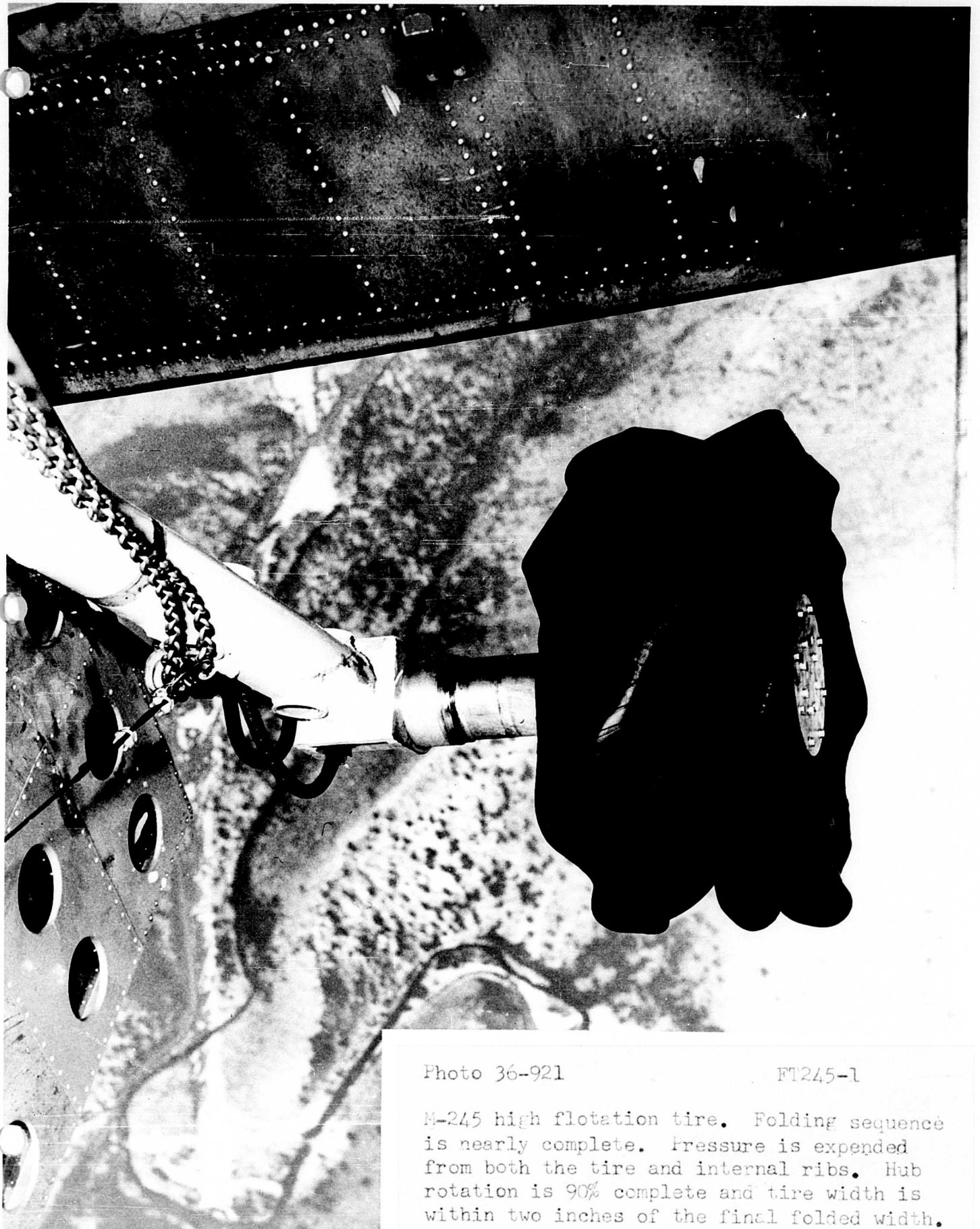


Photo 36-921

FT245-1

M-245 high flotation tire. Folding sequence is nearly complete. Pressure is expended from both the tire and internal ribs. Hub rotation is 90% complete and tire width is within two inches of the final folded width.

FAIRCHILD AIRCRAFT AND MISSILES DIVISION

H A G E R S T O W N 10, M A R Y L A N D

SUBJECT LANDING GEAR TEST DATA, M-245 B



PREPARED BY A. J. Atkinson REPORT NO. FT245-1, Appendix I
A. J. Atkinson
CHECKED BY J. A. Clopper MODEL M-245B
J. A. Clopper
APPROVED BY R. V. Ford COPY NO. _____
R. V. Ford
APPROVED BY D. W. Meller NO. OF PAGES 90 + 1
D. W. Meller
APPROVED BY R. A. Henson DATE January 22, 1960
R. A. Henson

REVISIONS

| REVISION DATE | PAGES AFFECTED | APPROVED |
|---------------|----------------|----------|
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| Table II | L-19A Landing Load Data, Original Tire and Landing Gear | 6-13 |
| Table III | L-19A High Flotation Tire Obstacle Loads | 14-47 |
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| <p style="text-align: center;"><u>PURPOSE</u></p> <p>To present data obtained in the initial ground and flight tests of the M-245B High Flotation Landing Gear installed on an L-19A aircraft.</p> <p style="text-align: center;"><u>REMARKS</u></p> <p>The data presented in Tables I through VI is a detailed tabulation of data discussed in Report No. FT245-1. Its publication by this report is for reference and record purposes only.</p> <p>Details of instrumentation and test configuration are also covered by the above report.</p> <p>The zero time referenced in these tables is the instant prior to obstacle contact or landing touchdown.</p> | | | | | |

| | | | | | | | |
|-------------------------|--|--|--|------------|--|------------------------------|--|
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| | | |
|---|-----------------------------------|--|
| <p align="center">TABLE I</p> <p align="center">L-19A ORIGINAL TIRE AND LANDING GEAR OBSTACLE LOADS</p> | | <p align="center">Tire Press. 21 psi</p> <p align="center">Data Request No. L-19-1</p> |
| <p>L-19A Flight No. L-19-2</p> <p>Test Conditions: Gross Wt. 2390 lbs, C.G. 33.5% m.a.c.</p> <p>2 1/8" Obstacle</p> | <p align="center">S/N 51-7441</p> | |

| Item (Event) | Time (Sec) | Vertical Load (Lbs) | Torsional Load (In.Lbs.) | Side Load (Lbs) | Drag Load (Lbs) | C.G. Load Factor (g's) | Long. Acc. (g's) | Forward Velocity (MFH) |
|--------------------------------------|------------|---------------------|--------------------------|-----------------|-----------------|------------------------|------------------|------------------------|
| Oscillograph Record No. 24243 | | | | | | | | |
| Prior to Obstacle | 0 | 1055 | 795 | -51 | 33 | | | 10.0 |
| Initial Drag Load | .025 | -138 | | | 465 | | | |
| Drag Load Springback | .050 | -193 | | | -851 | | | |
| Initial Longitudinal Accel. | .025 | | | | | | | |
| Longitudinal Accel. Rebound | .045 | | | | | | | |
| Maximum C.G. Load Factor (Pos.) | .067 | | | | | 1.40 | | |
| Maximum C.G. Load Factor (Neg.) | .200 | | | | | .92 | | |
| Maximum Vertical Load | .045 | 766 | | | | | | |
| Vertical Load Rebound | .067 | -357 | | | | | | |
| Maximum Side Load (Outbd.) | .029 | -69 | | 280 | 268 | | | |
| Maximum Side Load (Inbd.) | .067 | -357 | | -386 | -213 | | | |
| Maximum Torsion (Drag) | .045 | | -1695 | | | | | |
| Maximum Torsion Springback | .067 | | 2156 | | | | | |
| Oscillograph Record No. 24244 | | | | | | | | |
| Prior to Obstacle | 0 | 1100 | 660 | -41 | 41 | | | 20.0 |
| Initial Drag Load | .030 | -128 | | | 476 | | | |
| Drag Load Springback | .050 | -142 | | | -748 | | | |
| Initial Longitudinal Accel. | .030 | | | | | | | |
| Longitudinal Accel. Rebound | .050 | | | | | | | |
| Maximum C.G. Load Factor (Pos.) | .070 | | | | | 1.59 | | |
| Maximum C.G. Load Factor (Neg.) | .220 | | | | | .80 | | |
| Maximum Vertical Load | .040 | 803 | | | | | | |
| Vertical Load Rebound | .070 | -484 | | | | | | |
| Maximum Side Load (Outbd.) | .030 | -128 | | 372 | 476 | | | |
| Maximum Side Load (Inbd.) | .070 | 611 | | -183 | 310 | | | |
| Maximum Torsion (Drag) | .040 | | -1980 | | | | | |
| Maximum Torsion Springback | .070 | | 2393 | | | | | |

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| MODEL <u>M-245B</u> | | PREPARED BY | CHECKED BY | APPROVED BY | | | | |
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LANDING GEAR TEST DATA, M-245B | | DATE <u>January 22, 1960</u>
REVISED | | | |
| <p style="text-align: center;">TABLE I - continued</p> <p style="text-align: center;"><u>L-19A ORIGINAL TIRE AND LANDING GEAR OBSTACLE LOADS</u></p> <p>L-19A Flight No. <u>L-19-2</u> S/N <u>51-7441</u> Tire Pressure <u>21 psi</u>
 Test Conditions: Gross Weight <u>2390 lbs</u>, C.G. <u>33.5% m.a.c.</u> Data Request No. <u>L-19-1</u>
 <u>2 1/8" Obstacle</u></p> | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | Torsional
Load
(In Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Forward
Velocity
(MPH) |
| <u>Oscillograph Record No. 24345</u> | | | | | | | | |
| Prior to Obstacle | 0 | 1205 | 780 | -26 | 58 | | | 10.0 |
| Initial Drag Load | .030 | -124 | | | 436 | | | |
| Drag Load Springback | .060 | 123 | | | -788 | | | |
| Initial Longitudinal Accel. | .032 | | | | | | -.63 | |
| Longitudinal Accel. Rebound | .080 | | | | | | .52 | |
| Maximum C.G. Load Factor (Pos.) | .090 | | | | | 1.53 | | |
| Maximum C.G. Load Factor (Neg.) | .200 | | | | | .64 | | |
| Maximum Vertical Load | .040 | 451 | | | | | | |
| Vertical Load Rebound | .095 | -219 | | | | | | |
| Maximum Side Load (Outbd.) | .032 | -138 | | 332 | 427 | | | |
| Maximum Side Load (Inbd.) | .080 | 397 | | -143 | -7 | | | |
| Maximum Torsion (Drag) | .058 | | -1723 | | | | | |
| Maximum Torsion Springback | .085 | | 1835 | | | | | |
| <u>Oscillograph Record No. 24346</u> | | | | | | | | |
| Prior to Obstacle | 0 | 1070 | 550 | -30 | -46 | | | 20.0 |
| Initial Drag Load | .035 | 25 | | | 654 | | | |
| Drag Load Springback | .055 | 176 | | | -431 | | | |
| Initial Longitudinal Accel. | .010 | | | | | | -.19 | |
| Longitudinal Accel. Rebound | .140 | | | | | | .31 | |
| Maximum C.G. Load Factor (Pos.) | .070 | | | | | 1.51 | | |
| Maximum C.G. Load Factor (Neg.) | .180 | | | | | .76 | | |
| Maximum Vertical Load | .075 | 1010 | | | | | | |
| Vertical Load Rebound | .180 | -563 | | | | | | |
| Maximum Side Load (Outbd.) | .025 | 11 | | 398 | 623 | | | |
| Maximum Side Load (Inbd.) | .070 | 185 | | -390 | 171 | | | |
| Maximum Torsion (Drag) | .040 | | -1217 | | | | | |
| Maximum Torsion Springback | .057 | | 3074 | | | | | |

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| <p align="center">TABLE I - continued</p> <p align="center"><u>L-19A ORIGINAL TIRE AND LANDING GEAR OBSTACLE LOADS</u></p> <p> <u>L-19A Flight No. L-19-4</u> <u>S/N 51-7441</u>
 <u>Test Conditions: Gross Wt. 2365 Lbs, C.G. 33.5% m.a.c.</u>
 <u>2 1/8" Obstacle</u> <u>Tire Pressure 21 psi</u>
 <u>Data Request No. L-19-1</u> </p> | | | | | | | | |
|--|---------------|---------------------------|-------------------------------|-----------------------|-----------------------|------------------------------|------------------------|------------------------------|
| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(In Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Forward
Velocity
(MPH) |
| <u>Oscillograph Record No. 24361</u> | | | | | | | | |
| Prior to Obstacle | 0 | 970 | 855 | 101 | -12 | | | 20.8 |
| Initial Drag Load | .020 | -327 | | | 302 | | | |
| Drag Load Springback | .043 | -244 | | | -498 | | | |
| Initial Longitudinal Accel. | .015 | | | | | | | |
| Longitudinal Accel. Rebound | .043 | | | | | | | |
| Maximum C.G. Load Factor (Pos.) | .076 | | | | | | | |
| Maximum C.G. Load Factor (Neg.) | .050 | | | | | | | |
| Maximum Vertical Load | .064 | 988 | | | | | | |
| Vertical Load Rebound | .076 | -546 | | | | | | |
| Maximum Side Load (Outbd.) | .052 | 2 | | 115 | -396 | | | |
| Maximum Side Load (Inbd.) | .076 | 796 | | -85 | 279 | | | |
| Maximum Torsion (Drag) | .040 | | -1581 | | | | | |
| Maximum Torsion Springback | .066 | | 3044 | | | | | |

MODEL

M-245B

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SUBJECT:- LANDING GEAR TEST DATA, M-245B

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TABLE I - continued
L-19A ORIGINAL TIRE AND LANDING GEAR OBSTACLE LOADS

L-19A Flight No. L-19-5

S/N 51-7441

Tire Pressure 21 psi

Data Request No. L-19-1

Test Conditions: Gross Wt. 2400 lbs, C.G. 33.5% m.a.c.

2-1/8" Obstacle

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(In Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Forward
Velocity
(MPH) |
|---------------------------------|---------------|---------------------------|-------------------------------|-----------------------|-----------------------|------------------------------|------------------------|------------------------------|
| Oscillograph Record No. 24372 | | | | | | | | |
| Prior to Obstacle | 0 | 1150 | 640 | -71 | 4 | | | 14.3 |
| Initial Drag Load | .030 | -145 | | | 516 | | | |
| Drag Load Springback | .060 | -201 | | | -974 | | | |
| Initial Longitudinal Accel. | .030 | | | | | | -.53 | |
| Longitudinal Accel. Rebound | .060 | | | | | | .99 | |
| Maximum C.G. Load Factor (Pos.) | .090 | | | | | 1.95 | | |
| Maximum C.G. Load Factor (Neg.) | .110 | | | | | .33 | | |
| Maximum Vertical Load | .080 | 750 | | | | | | |
| Vertical Load Rebound | .100 | -438 | | | | | | |
| Maximum Side Load (Outbd.) | .030 | -145 | | 336 | 516 | | | |
| Maximum Side Load (Inbd.) | .080 | 750 | | -251 | 154 | | | |
| Maximum Torsion (Drag) | .060 | | -1626 | | | | | |
| Maximum Torsion Springback | .080 | | 2114 | | | | | |
| Oscillograph Record No. 24373 | | | | | | | | |
| Prior to Obstacle | 0 | 1165 | 640 | -81 | 41 | | | 22.8 |
| Initial Drag Load | .030 | -188 | | | 469 | | | |
| Drag Load Springback | .050 | 87 | | | -511 | | | |
| Initial Longitudinal Accel. | .030 | | | | | | -.50 | |
| Longitudinal Accel. Rebound | .055 | | | | | | 1.13 | |
| Maximum C.G. Load Factor (Pos.) | .085 | | | | | 2.41 | | |
| Maximum C.G. Load Factor (Neg.) | .100 | | | | | -.39 | | |
| Maximum Vertical Load | .075 | 999 | | | | | | |
| Vertical Load Rebound | .090 | -537 | | | | | | |
| Maximum Side Load (Outbd.) | .040 | -481 | | 111 | -46 | | | |
| Maximum Side Load (Inbd.) | .060 | 971 | | -224 | 147 | | | |
| Maximum Torsion (Drag) | .040 | | -1757 | | | | | |
| Maximum Torsion Springback | .075 | | 3350 | | | | | |

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| TABLE II
L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR | | | | | | | | | |
|---|---------------|---------------------------|----------------------------|-----------------------|-----------------------|------------------------------|------------------------|------------------------|--|
| L-19A Flight No. L-19-1 S/N 51-7441 Tire Pressure 21 psi Data Request No. L-19-2 | | | | | | | | | |
| Test Conditions: Gr. Wt. 2520 lbs, C.G. 33.5% m.a.c. | | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Sink
Speed
(F/S) | |
| Oscillograph Record No. 24301 | | | | | | | | | |
| Touchdown | 0 | | | | | | | 4.30 | |
| Initial Drag Load | 0.03 | - 67 | | | 383 | | | | |
| Drag Load Springback | 0.23 | 1088 | | | -103 | | | | |
| Initial Longitudinal Accel. | 0.04 | | | | | | -0.40 | | |
| Longitudinal Accel., Rebound | 0.27 | | | | | | 0.07 | | |
| Maximum C.G. Load Factor (Pos.) | 0.23 | | | | | 1.97 | | | |
| Maximum C.G. Load Factor (Neg.) | 0.56 | | | | | 0.68 | | | |
| Maximum Vertical Load | 0.26 | 1101 | | | | | | | |
| Vertical Load Rebound | 0.51 | -175 | | | | | | | |
| Maximum Side Load (Outbd.) | 0.07 | - 27 | | 149 | -176 | | | | |
| Maximum Side Load (Inbd.) | 0.33 | 1007 | | -140 | - 41 | | | | |
| Maximum Torsion (Drag) | 0.09 | | -1480 | | | | | | |
| Maximum Torsion Springback | 0.29 | | 465 | | | | | | |
| Oscillograph Record No. 24302 | | | | | | | | | |
| Touchdown | 0 | | | | | | | 3.66 | |
| Initial Drag Load | 0.03 | - 40 | | | 358 | | | | |
| Drag Load Springback | 0.19 | 1155 | | | - 76 | | | | |
| Initial Longitudinal Accel. | 0.03 | | | | | | -0.53 | | |
| Longitudinal Accel., Rebound | 0.26 | | | | | | 0.20 | | |
| Maximum C.G. Load Factor (Pos.) | 0.25 | | | | | 1.92 | | | |
| Maximum C.G. Load Factor (Neg.) | 0.56 | | | | | 0.68 | | | |
| Maximum Vertical Load | 0.23 | 1276 | | | | | | | |
| Vertical Load Rebound | 0.54 | -121 | | | | | | | |
| Maximum Side Load (Outbd.) | 0.06 | 40 | | 137 | 35 | | | | |
| Maximum Side Load (Inbd.) | 0.40 | 806 | | -147 | 47 | | | | |
| Maximum Torsion (Drag) | 0.09 | | -1096 | | | | | | |
| Maximum Torsion Springback | 0.25 | | 1170 | | | | | | |

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| SUBJECT: - <u>APPENDIX I</u>
<u>LANDING GEAR TEST DATA, M-245B</u> | | | | | | DATE <u>January 22, 1960</u>
REVISED | | |
| <p style="text-align: center;">TABLE II - continued</p> <p style="text-align: center;"><u>L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR</u></p> <p style="text-align: center;">S/N <u>51-7441</u>
Tire Pressure <u>21 psi</u>
Data Request No. <u>L-19-2</u></p> <p style="text-align: center;">L-19A Flight No. <u>L-19-1</u>
Test Conditions: Gross Wt. <u>2580 lbs</u>, C.G. <u>33.5% m.a.c.</u></p> | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Sink
Speed
(FPS) |
| <u>Oscillograph Record No. 24304</u> | | | | | | | | |
| Touchdown | 0 | | | | | | | 2.50 |
| Initial Drag Load | 0.08 | 282 | | | 298 | | | |
| Drag Load Springback | 0.13 | 457 | | | -750 | | | |
| Initial Longitudinal Accel. | 0.07 | | | | | | -0.35 | |
| Longitudinal Accel. Rebound | 0.26 | | | | | | 0.07 | |
| Maximum C.G. Load Factor (Pos.) | 0.20 | | | | | 1.61 | | |
| Maximum C.G. Load Factor (Neg.) | 0.73 | | | | | 0.82 | | |
| Maximum Vertical Load | 0.25 | 819 | | | | | | |
| Vertical Load Rebound | 0.55 | -148 | | | | | | |
| Maximum Side Load (Outbd.) | 0.12 | 389 | | 343 | -588 | | | |
| Maximum Side Load (Inbd.) | 0.36 | 685 | | 91 | 36 | | | |
| Maximum Torsion (Drag) | 0.12 | | -1420 | | | | | |
| Maximum Torsion Springback | 0.29 | | 585 | | | | | |

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| MODEL M-245B | | PREPARED BY | | APPROVED BY | |
| | | CHECKED BY | | DATE January 22, 1960 | |
| SUBJECT: APPENDIX I
LANDING GEAR TEST DATA, M-245B | | | | REVISED | |

TABLE II - continued

L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR

L-19A Flight No. **L-19-1** S/N **51-7441**

Test Conditions: Gross Wt. **2390 lbs**, C.G. **33.5% m.a.c.**

Tire Pressure **21 psi**
Data Request No. **L-19-2**

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(In.Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Sink
Speed
(FPS) |
|--------------------------------------|---------------|---------------------------|-------------------------------|-----------------------|-----------------------|------------------------------|------------------------|------------------------|
| Oscillograph Record No. <u>24347</u> | | | | | | | | |
| Touchdown | 0 | | | | | | | 2.90 |
| Initial Drag Load | .050 | 137 | | | 160 | | | |
| Drag Load Springback | .125 | 685 | | | -202 | | | |
| Initial Longitudinal Accel. | .027 | | | | | | -.46 | |
| Longitudinal Accel. Rebound | .170 | | | | | | .22 | |
| Maximum C.G. Load Factor (Pos.) | .180 | | | | | 1.99 | | |
| Maximum C.G. Load Factor (Neg.) | .520 | | | | | .76 | | |
| Maximum Vertical Load | .275 | 1259 | | | | | | |
| Vertical Load Rebound | .520 | -191 | | | | | | |
| Maximum Side Load (Outbd.) | .027 | 41 | | 155 | 114 | | | |
| Maximum Side Load (Inbd.) | .355 | 1013 | | -189 | 45 | | | |
| Maximum Torsion (Drag) | .100 | | -508 | | | | | |
| Maximum Torsion Springback | .270 | | 1204 | | | | | |

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| MODEL | M-245B | PREPARED BY | CHECKED BY | APPROVED BY | |
| SUBJECT:- | | | | DATE January 22, 1960 | |
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LANDING GEAR TEST DATA, M-245B | | | | REVISED | |

TABLE II - continued
L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR
 L-19A Flight No. L-19-2 S/N 51-7441
 Test Conditions: Gross Wt. 2390 lbs, C.G. 33.5% m.a.c.
 Tire Pressure 21 psi
 Data Request No. L-19-2

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(In.Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Sink
Speed
(FPS) |
|---------------------------------|---------------|---------------------------|-------------------------------|-----------------------|-----------------------|------------------------------|------------------------|------------------------|
| Oscillograph Record No. 24342 | | | | | | | | |
| Touchdown | 0 | | | | | | | 2.48 |
| Initial Drag Load | .065 | 178 | | | 213 | | | |
| Drag Load Springback | .110 | 233 | | | -219 | | | |
| Initial Longitudinal Accel. | .060 | | | | | | -.35 | |
| Longitudinal Accel. Rebound | .165 | | | | | | .18 | |
| Maximum C.G. Load Factor (Pos.) | .150 | | | | | 1.59 | | |
| Maximum C.G. Load Factor (Neg.) | .570 | | | | | .68 | | |
| Maximum Vertical Load | .255 | 657 | | | | | | |
| Vertical Load Rebound | .510 | -301 | | | | | | |
| Maximum Side Load (Outbd.) | .120 | 260 | | 96 | -197 | | | |
| Maximum Side Load (Inbd.) | .275 | 630 | | -60 | -64 | | | |
| Maximum Torsion (Drag) | .120 | | -687 | | | | | |
| Maximum Torsion Springback | .295 | | -160 | | | | | |

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| SUBJECT: <u>APPENDIX I</u> | | DATE <u>January 22, 1960</u> | | REVISED | | | | |
| <p><u>L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR</u></p> <p><u>L-19A Flight No. L-19-4</u></p> <p><u>Test Conditions: Gross Wt. 2365 lbs, C.G. 33.5% m.a.c.</u></p> <p><u>S/N 51-7441</u></p> <p><u>Tire Pressure 21 psi</u></p> <p><u>Data Request No. L-19-2</u></p> | | <p><u>APPENDIX I</u></p> <p><u>LANDING GEAR TEST DATA, M-245B</u></p> | | | | | | |
| <p><u>TABLE II - continued</u></p> | | | | | | | | |
| <p><u>L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR</u></p> | | | | | | | | |
| <p><u>L-19A Flight No. L-19-4</u></p> <p><u>Test Conditions: Gross Wt. 2365 lbs, C.G. 33.5% m.a.c.</u></p> <p><u>S/N 51-7441</u></p> <p><u>Tire Pressure 21 psi</u></p> <p><u>Data Request No. L-19-2</u></p> | | | | | | | | |
| <p><u>Oscillograph Record No. 24353</u></p> | | | | | | | | |
| Item (Event) | Time (Sec.) | Vertical Load (Lbs) | Torsional Load (In. Lbs) | Side Load (Lbs) | Drag Load (Lbs) | C.G. Load Factor (g's) | Long. Acc. (g's) | Sink Speed (FPS) |
| Touchdown | 0 | | | | | | | 2.14 |
| Initial Drag Load | .052 | 137 | | | 197 | | | |
| Drag Load Springback | .114 | 178 | | | -383 | | | |
| Initial Longitudinal Accel. | .028 | | | | | | -.43 | |
| Longitudinal Accel. Rebound | .140 | | | | | | .10 | |
| Maximum C.G. Load Factor (Pos.) | .140 | | | | | 1.57 | | |
| Maximum C.G. Load Factor (Neg.) | .680 | | | | | .76 | | |
| Maximum Vertical Load | .250 | 397 | | | | | | |
| Vertical Load Rebound | .515 | -287 | | | | | | |
| Maximum Side Load (Outbd.) | .120 | 178 | | 19 | -327 | | | |
| Maximum Side Load (Inbd.) | .310 | 315 | | -22 | -79 | | | |
| Maximum Torsion (Drag) | .132 | | -958 | | | | | |
| Maximum Torsion Springback | .310 | | -363 | | | | | |

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<u>LANDING GEAR TEST DATA, M-245B</u> | | | | DATE <u>January 22, 1960</u> | |
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| L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR | | Tire Pressure 21 psi | | Data Request No. L-19-2 | | | | |
|---|----------------|---------------------------|--------------------------------|-------------------------|-----------------------|------------------------------|------------------------|------------------------|
| L-19A Flight No. L-19-4 | | S/N 51-7441 | | | | | | |
| Test Conditions: Gross Wt. 2365 lbs, C.G. 33.5% m.a.c. | | | | | | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(Lbs) | Torsional
Load
(In. Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Sink
Speed
(FPS) |
| Oscillograph Record No. <u>24362</u> | | | | | | | | |
| Touchdown | 0 | | | | | | | 2.23 |
| Initial Drag Load | .075 | 164 | | | 249 | | | |
| Drag Load Springback | .112 | 287 | | | -294 | | | |
| Initial Longitudinal Accel. | .035 | | | | | | | |
| Longitudinal Accel. Rebound | .135 | | | | | | | |
| Maximum C.G. Load Factor (Pos.) | .177 | | | | | 1.77 | | |
| Maximum C.G. Load Factor (Neg.) | .645 | | | | | .73 | | |
| Maximum Vertical Load | .248 | 685 | | | | | | |
| Vertical Load Rebound | .490 | - 54 | | | | | | |
| Maximum Side Load (Outbd.) | .290 | 589 | | -105 | -10 | | | |
| Maximum Side Load (Inbd.) | .490 | - 54 | | 5 | -27 | | | |
| Maximum Torsion (Drag) | .122 | | -334 | | | | | |
| Maximum Torsion Springback | .255 | | 352 | | | | | |

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<u>LANDING GEAR TEST DATA, M-245B</u> | | | | | DATE <u>January 22, 1960</u> | |
| | | | | | REVISED _____ | |

TABLE II - continued

L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR

L-19A Flight No. L-19-5 S/N 51-7441

Test Conditions: Gross Weight 2400 lbs, C.G. 33.5% m.a.c.

Tire Pressure 21 psi

Data Request No. L-19-2

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(In. Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Sink
Speed
(FPS) |
|--------------------------------------|---------------|---------------------------|--------------------------------|-----------------------|-----------------------|------------------------------|------------------------|------------------------|
| Oscillograph Record No. <u>24371</u> | | | | | | | | |
| Touchdown | 0 | | | | | | | 3.15 |
| Initial Drag Load | .060 | 223 | | | 235 | | | |
| Drag Load Springback | .105 | 447 | | | -77 | | | |
| Initial Longitudinal Accel. | .080 | | | | | | | |
| Longitudinal Accel. Rebound | .120 | | | | | | | |
| Maximum C.G. Load Factor (Pos.) | .180 | | | | | | | |
| Maximum C.G. Load Factor (Neg.) | .600 | | | | | 1.67 | | |
| Maximum Vertical Load | .240 | 921 | | | | .74 | | |
| Vertical Load Rebound | .510 | -70 | | | | | | |
| Maximum Side Load (Outbd.) | .300 | 824 | | | 150 | | | |
| Maximum Side Load (Inbd.) | .525 | -28 | | -179 | - 2 | | | |
| Maximum Torsion (Drag) | .260 | | 1056 | | | | | |
| Maximum Torsion Springback | .495 | | - 87 | | | | | |

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|---|---------------|--|--------------------------------|-----------------------|-----------------------|------------------------------|------------------------|------------------------|
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| APPENDIX I
LANDING GEAR TEST DATA, M-245B | | | | REVISED | | | | |
| <p style="text-align: center;">TABLE II - continued</p> <p style="text-align: center;">L-19A LANDING LOAD DATA, ORIGINAL TIRE AND LANDING GEAR</p> <p style="text-align: center;">S/N 51-7441</p> <p style="text-align: center;">L-19A Flight No. L-19-5</p> <p style="text-align: center;">Tire Pressure 21 psi</p> <p style="text-align: center;">Data Request No. L-19-2</p> <p style="text-align: center;">Test Conditions: Gross Wt. 2400 lbs, C.G. 33.5% m.a.c.</p> | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Torsional
Load
(In. Lbs) | Side
Load
(Lbs) | Drag
Load
(Lbs) | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Sink
Speed
(FPS) |
| Oscillograph Record No. 24374 | | | | | | | | |
| Touchdown | 0 | | | | | | | 1.1 |
| Initial Drag Load | .085 | 126 | | | 170 | | | |
| Drag Load Springback | .145 | 98 | | | -128 | | | |
| Initial Longitudinal Accel. | .105 | | | | | | -.27 | |
| Longitudinal Accel. Reboud | .195 | | | | | | -.07 | |
| Maximum C.G. Load Factor (Pos.) | .230 | | | | | 1.36 | | |
| Maximum C.G. Load Factor (Neg.) | .640 | | | | | .82 | | |
| Maximum Vertical Load | .270 | 168 | | | | | | |
| Vertical Load Reboud | .465 | -195 | | | | | | |
| Maximum Side Load (Outbd.) | .190 | 126 | | 50 | -170 | | | |
| Maximum Side Load (Inbd.) | - | - | | - | - | | | |
| Maximum Torsion (Drag) | .210 | | -609 | | | | | |
| Maximum Torsion Springback | - | | - | | | | | |

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TABLE III
L-19A HIGH FLUTATION TIRE OBSTACLE LOADS

L-19A Ground Tests S/N 51-7441 May 27, 1959
Obstacle Height 2 1/8" Tire Pressure 2.7 psi Data Request No. L-19-5

| ITEM
(Event) | TIME
(Sec) | Vertical
Load
(Lbs.) | Drag Strut
Axial Load
(Lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. <u>24591</u> | | | | | | | |
| Prior to obstacle | 0 | 820 | -340 | | | | 21.7 |
| Initial Drag Strut Axial Load | .036 | 140 | 330 | | -.17 | | |
| Drag Strut Axial Load, Springback | .060 | 20 | -425 | | .23 | | |
| Drag Strut Axial Load, 2nd cycle | .107 | 40 | 310 | | -.05 | | |
| Maximum Vertical Load | .075 | 220 | -50 | .29 | | | |
| Vertical Load Rebound | .094 | -35 | -155 | -.47 | | | |
| Maximum Normal Acceleration (Pos.) | .113 | 45 | | .39 | | | |
| Maximum Normal Acceleration (Neg.) | .033 | -5 | | -.49 | | | |
| Maximum Longitudinal Acc. (Positive) | .032 | 160 | -155 | | .35 | | |
| Maximum Longitudinal Acc. (Negative) | .099 | -55 | 115 | | -.31 | | |
| Maximum Lateral Acc. (Pos., to Right) | .160 | 20 | -115 | | | .37 | |
| Maximum Lateral Acc. (Neg., to Left) | .139 | -45 | 10 | | | -.59 | |
| Oscillograph Record No. <u>24720</u> | | | | | | | |
| Prior to obstacle | 0 | 905 | -170 | | | | 26.3 |
| Initial Drag Strut Axial Load | .023 | 105 | 305 | | -.07 | | |
| Drag Strut Axial Load, Springback | .073 | -160 | -495 | | .13 | | |
| Drag Strut Axial Load, 2nd cycle | .092 | -35 | 160 | | .00 | | |
| Maximum Vertical Load | .059 | 135 | -115 | .22 | | | |
| Vertical Load Rebound | .075 | -135 | -330 | -.63 | | | |
| Maximum Normal Acc. (Positive) | .055 | 135 | | .51 | | | |
| Maximum Normal Acc. (Negative) | .075 | -185 | | -.68 | | | |
| Maximum Longitudinal Acc. (Positive) | .059 | 135 | -115 | | .29 | | |
| Maximum Longitudinal Acc. (Negative) | .119 | -135 | 160 | | -.16 | | |
| Maximum Lateral Acc. (Pos., to Right) | .100 | -55 | 115 | | | .47 | |
| Maximum Lateral Acc. (Neg., to Left) | .125 | -115 | 75 | | | -.41 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | |
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TABLE III - continued

L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests S/N 51-7441 Data Request No. L-19-5
Obstacle Height 2 1/3" Tire Pressure 2.7 psi

| ITEM
Oscillograph Record No. <u>24593</u> | TIME
(Sec) | Vertical
Load
(Lbs.) | Drag Strut
Axial Load
(Lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|--|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | 0 | 330 | -230 | | | | 28.5 |
| Initial Drag Strut Axial Load | .033 | 185 | 445 | | -.50 | | |
| Drag Strut Axial Load, Springback | .072 | -100 | -590 | | .57 | | |
| Drag Strut Axial Load, 2nd cycle | .109 | -25 | 70 | | -.09 | | |
| Maximum Vertical Load | .027 | 245 | 240 | -.03 | | | |
| Vertical Load Rebound | .073 | -145 | -455 | -.52 | | | |
| Maximum Normal Acc. (Positive) | .060 | 245 | | .30 | | | |
| Maximum Normal Acc. (Negative) | .076 | -135 | | -.53 | | | |
| Maximum Longitudinal Acc. (Positive) | .072 | -100 | -590 | | .57 | | |
| Maximum Longitudinal Acc. (Negative) | .033 | 185 | 445 | | -.50 | | |
| Maximum Lateral Acc. (Pos., to Right) | .107 | -35 | 260 | | | .42 | |
| Maximum Lateral Acc. (Neg., to Left) | .130 | 25 | -155 | | | -.53 | |
| Oscillograph Record No. <u>24597</u> | | | | | | | |
| Prior to obstacle | 0 | 770 | -155 | | | | 34.0 |
| Initial Drag Strut Axial Load | .019 | 125 | 435 | | -.24 | | |
| Drag Strut Axial Load, Springback | .054 | -80 | -650 | | .45 | | |
| Drag Strut Axial Load, 2nd cycle | .083 | -80 | 350 | | -.01 | | |
| Maximum Vertical Load | .011 | 395 | -165 | .35 | | | |
| Vertical Load Rebound | .068 | -175 | -155 | -.25 | | | |
| Maximum Normal Acc. (Positive) | .042 | 95 | | .47 | | | |
| Maximum Normal Acc. (Negative) | .020 | 95 | | -.60 | | | |
| Maximum Longitudinal Acc. (Positive) | .051 | -40 | -590 | | .55 | | |
| Maximum Longitudinal Acc. (Negative) | .020 | 95 | 425 | | -.45 | | |
| Maximum Lateral Acc. (Pos., to Right) | .093 | -85 | 260 | | | .25 | |
| Maximum Lateral Acc. (Neg., to Left) | .035 | 5 | 70 | | | -.29 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values. All G values are also incremental.

| | | | | | |
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TABLE III - continued
L-19A HIGH FLUTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 2 1/8" S/N 51-7441
Tire Pressure 3.6±.2 psi Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs.) | Drag Strut
Axial Load
(Lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24531 | | | | | | | |
| Prior to obstacle | 0 | 895 | -350 | | | | 14.7 |
| Initial Drag Strut Axial Load | .043 | 210 | 285 | | -.12 | | |
| Drag Strut Axial Load, Springback | .075 | -60 | -380 | | .21 | | |
| Drag Strut Axial Load, 2nd cycle | .132 | -35 | 190 | | -.11 | | |
| Maximum Vertical Load | .033 | 220 | 390 | .04 | | | |
| Vertical Load Rebound | .150 | -150 | 40 | -.03 | | | |
| Maximum Normal Acc. (Positive) | .083 | 85 | | .25 | | | |
| Maximum Normal Acc. (Negative) | .110 | 35 | | -.29 | | | |
| Maximum Longitudinal Acc. (Positive) | .070 | -75 | -325 | | .32 | | |
| Maximum Longitudinal Acc. (Negative) | .022 | 175 | 180 | | -.25 | | |
| Maximum Lateral Acc. (Pos., to Right) | .175 | -55 | 10 | | | .23 | |
| Maximum Lateral Acc. (Neg., to Left) | .204 | -25 | 75 | | | -.23 | |
| Oscillograph Record No. 24486 | | | | | | | |
| Prior to obstacle | 0 | 925 | -460 | | | | 16.1 |
| Initial Drag Strut Axial Load | .039 | 175 | 295 | | -.06 | | |
| Drag Strut Axial Load, Springback | .065 | -20 | -400 | | .15 | | |
| Drag Strut Axial Load, 2nd cycle | .120 | -5 | 260 | | -.02 | | |
| Maximum Vertical Load | .028 | 215 | 240 | .12 | | | |
| Vertical Load Rebound | .059 | -55 | -310 | .00 | | | |
| Maximum Normal Acc. (Positive) | .075 | 125 | | .39 | | | |
| Maximum Normal Acc. (Negative) | .093 | 25 | | -.37 | | | |
| Maximum Longitudinal Acc. (Positive) | .061 | -45 | -360 | | .40 | | |
| Maximum Longitudinal Acc. (Negative) | .100 | 20 | -20 | | -.14 | | |
| Maximum Lateral Acc. (Pos., to Right) | .165 | -35 | 80 | | | .23 | |
| Maximum Lateral Acc. (Neg., to Left) | .200 | -70 | 5 | | | -.23 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
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|--|---------------|--|--|-------------------------|------------------------|-----------------------|----------------|
| <p style="text-align: center;">TABLE III - continued</p> <p style="text-align: center;">L-19A HIGH FLOTATION TIRE OBSTACLE LOADS</p> | | <p style="text-align: center;">S/N 51-7441</p> <p style="text-align: center;">Tire Pressure 3.6±.2 psi</p> | <p style="text-align: center;">Data Request No. L-19-5</p> | | | | |
| <p style="text-align: center;">L-19A Ground Tests</p> <p style="text-align: center;">Obstacle Height 2 1/8"</p> | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs.) | Drag Strut
Axial Load
(Lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. <u>24533</u> | | | | | | | |
| Prior to obstacle | 0 | 910 | -305 | | | | 22.1 |
| Initial Drag Strut Axial Load | .039 | 130 | 350 | | .03 | | |
| Drag Strut Axial Load, Springback | .074 | 0 | -750 | | .27 | | |
| Drag Strut Axial Load, 2nd cycle | .096 | -60 | 465 | | -.21 | | |
| Maximum Vertical Load | .025 | 255 | 245 | .25 | | | |
| Vertical Load Rebound | .034 | -130 | -245 | -.52 | | | |
| Maximum Normal Acc. (Positive) | .060 | 110 | | .66 | | | |
| Maximum Normal Acc. (Negative) | .032 | -155 | | -.64 | | | |
| Maximum Longitudinal Acc. (Positive) | .050 | -45 | -245 | | .52 | | |
| Maximum Longitudinal Acc. (Negative) | .090 | -115 | 295 | | -.44 | | |
| Maximum Lateral Acc. (Pos., to Right) | .160 | -140 | 95 | | | .43 | |
| Maximum Lateral Acc. (Neg., to Left) | .132 | -55 | -380 | | | -.53 | |
| Oscillograph Record No. <u>24487</u> | | | | | | | |
| Prior to obstacle | 0 | 775 | -395 | | | | 22.3 |
| Initial Drag Strut Axial Load | .031 | 60 | 295 | | -.29 | | |
| Drag Strut Axial Load, Springback | .065 | -15 | -900 | | .95 | | |
| Drag Strut Axial Load, 2nd cycle | .037 | 25 | 655 | | -.46 | | |
| Maximum Vertical Load | .020 | 295 | 220 | .37 | | | |
| Vertical Load Rebound | .073 | -195 | 25 | -1.16 | | | |
| Maximum Normal Acc. (Positive) | .053 | 195 | | 1.12 | | | |
| Maximum Normal Acc. (Negative) | .075 | -315 | | -1.24 | | | |
| Maximum Longitudinal Acc. (Positive) | .060 | 125 | -700 | | 1.07 | | |
| Maximum Longitudinal Acc. (Negative) | .079 | -175 | 200 | | -.89 | | |
| Maximum Lateral Acc. (Pos., to Right) | .162 | -45 | 235 | | | .12 | |
| Maximum Lateral Acc. (Neg., to Left) | .137 | -80 | -220 | | | -.25 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | |
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TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 2 1/8" S/N 51-7441
Tire Pressure 3.6±.2 psi Data Request No. L-19-5

| Item
(Event) | Oscillograph Record No. 24722 | Time
(Sec) | Vertical
Load
(Lbs.) | Drag Strut
Axial Load
(Lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|-------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 740 | -245 | | | | 33.1 |
| Initial Drag Strut Axial Load | | .065 | 405 | 445 | | -.27 | | |
| Drag Strut Axial Load, Springback | | .092 | 45 | -1110 | | .52 | | |
| Drag Strut Axial Load, 2nd cycle | | .121 | 15 | 645 | | -.57 | | |
| Maximum Vertical Load | | .058 | 510 | 275 | .32 | | | |
| Vertical Load Rebound | | .116 | -5 | 340 | .13 | | | |
| Maximum Normal Acc. (Positive) | | .082 | 300 | | .72 | | | |
| Maximum Normal Acc. (Negative) | | .070 | 280 | | -.53 | | | |
| Maximum Longitudinal Acc. (Positive) | | .039 | 120 | -940 | | .53 | | |
| Maximum Longitudinal Acc. (Negative) | | .121 | 15 | 645 | | -.57 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .139 | 45 | 315 | | | .61 | |
| Maximum Lateral Acc. (Neg., to Left) | | .164 | 155 | -125 | | | -.42 | |
| | | | | | | | | |
| Oscillograph Record No. 24721 | | | | | | | | |
| Prior to Obstacle | | 0 | 500 | -125 | | | | 41.6 |
| Initial Drag Strut Axial Load | | .023 | 465 | 455 | | -.33 | | |
| Drag Strut Axial Load, Springback | | .042 | 85 | -930 | | .49 | | |
| Drag Strut Axial Load, 2nd cycle | | .073 | 65 | 475 | | .03 | | |
| Maximum Vertical Load | | .023 | 465 | 455 | .40 | | | |
| Vertical Load Rebound | | .073 | 65 | 475 | .25 | | | |
| Maximum Normal Acc. (Positive) | | .020 | 460 | | .53 | | | |
| Maximum Normal Acc. (Negative) | | .110 | 260 | | -.64 | | | |
| Maximum Longitudinal Acc. (Positive) | | .042 | 85 | -930 | | .49 | | |
| Maximum Longitudinal Acc. (Negative) | | .023 | 465 | 455 | | -.33 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .151 | 145 | -10 | | | .79 | |
| Maximum Lateral Acc. (Neg., to Left) | | .128 | 125 | 65 | | | -.38 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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|--|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-------------------------|----------------|
| TABLE III - continued | | L-19A Ground Tests | | S/N 51-7441 | | Data Request No. L-19-5 | |
| L-19A HIGH FLOTATION TIRE OBSTACLE LOADS | | Obstacle Height 2 1/8" | | Tire Pressure 4.9 psi | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(Lbs.) | Drag Strut
Axial Load
(Lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. <u>24541</u> | | | | | | | |
| Prior to obstacle | 0 | 955 | -390 | | | | 11.1 |
| Initial Drag Strut Axial Load | .035 | 230 | 190 | | -.05 | | |
| Drag Strut Axial Load, Springback | .119 | 120 | -325 | | .15 | | |
| Drag Strut Axial Load, 2nd cycle | .150 | 150 | 170 | | .05 | | |
| Maximum Vertical Load | .045 | 250 | 135 | .12 | | | |
| Vertical Load Rebound | .170 | -260 | -75 | .03 | | | |
| Maximum Normal Acc. (Positive) | .099 | 40 | | .39 | | | |
| Maximum Normal Acc. (Negative) | .128 | 80 | | -.35 | | | |
| Maximum Longitudinal Acc. (Positive) | .039 | -55 | -125 | | .23 | | |
| Maximum Longitudinal Acc. (Negative) | .021 | 190 | 160 | | -.12 | | |
| Maximum Lateral Acc. (Pos., to Right) | .105 | 110 | -295 | | | .31 | |
| Maximum Lateral Acc. (Neg., to Left) | .222 | -140 | 55 | | | -.32 | |
| Oscillograph Record No. <u>24542</u> | | | | | | | |
| Prior to obstacle | 0 | 360 | -400 | | | | 17.0 |
| Initial Drag Strut Axial Load | .040 | 230 | 220 | | -.04 | | |
| Drag Strut Axial Load, Springback | .078 | 35 | -760 | | .29 | | |
| Drag Strut Axial Load, 2nd cycle | .103 | -110 | 560 | | -.37 | | |
| Maximum Vertical Load | .030 | 270 | 190 | .10 | | | |
| Vertical Load Rebound | .156 | -170 | 125 | -.21 | | | |
| Maximum Normal Acc. (Positive) | .111 | -110 | | .53 | | | |
| Maximum Normal Acc. (Negative) | .033 | -60 | | -.54 | | | |
| Maximum Longitudinal Acc. (Positive) | .063 | 75 | -445 | | .47 | | |
| Maximum Longitudinal Acc. (Negative) | .105 | -95 | 530 | | -.41 | | |
| Maximum Lateral Acc. (Pos., to Right) | .165 | -150 | 230 | | | .42 | |
| Maximum Lateral Acc. (Neg., to Left) | .192 | -130 | -150 | | | -.35 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests Data Request No. L-19-5
 Obstacle Height 2 1/8" S/N 51-7441
Tire Pressure 4.9 psi

| Item
(Event) | Oscillograph Record No. <u>24543</u> | Time
(Sec.) | Vertical
Load
(Lbs.) | Drag Strut
Axial Load
(Lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|--------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 835 | -255 | | | | 25.1 |
| Initial Drag Strut Axial Load | | .032 | 235 | 350 | | -.33 | | |
| Drag Strut Axial Load, Springback | | .059 | -80 | -1195 | | .27 | | |
| Drag Strut Axial Load, 2nd cycle | | .033 | -80 | 750 | | -.23 | | |
| Maximum Vertical Load | | .022 | 365 | 265 | .35 | | | |
| Vertical Load Rebound | | .230 | -215 | -210 | .06 | | | |
| Maximum Normal Acc. (Positive) | | .090 | -60 | | .72 | | | |
| Maximum Normal Acc. (Negative) | | .067 | -155 | | -.63 | | | |
| Maximum Longitudinal Acc. (Positive) | | .051 | 190 | -590 | | .88 | | |
| Maximum Longitudinal Acc. (Negative) | | .072 | -160 | 200 | | -.56 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .093 | -75 | 275 | | | .47 | |
| Maximum Lateral Acc. (Neg., to Left) | | .127 | 5 | -105 | | | -.36 | |
| | | | | | | | | |
| Prior to obstacle | | 0 | 735 | -230 | | | | 27.0 |
| Initial Drag Strut Axial Load | | .027 | 335 | 360 | | -.27 | | |
| Drag Strut Axial Load, Springback | | .050 | -95 | -1025 | | .32 | | |
| Drag Strut Axial Load, 2nd cycle | | .030 | -130 | 645 | | -.48 | | |
| Maximum Vertical Load | | .017 | 310 | 245 | .25 | | | |
| Vertical Load Rebound | | .072 | -200 | 315 | .16 | | | |
| Maximum Normal Acc. (Positive) | | .042 | 150 | | .49 | | | |
| Maximum Normal Acc. (Negative) | | .060 | -150 | | -.41 | | | |
| Maximum Longitudinal Acc. (Positive) | | .044 | 75 | -825 | | .76 | | |
| Maximum Longitudinal Acc. (Negative) | | .080 | -130 | 645 | | -.47 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .033 | -60 | 420 | | | .39 | |
| Maximum Lateral Acc. (Neg., to Left) | | .121 | 75 | -65 | | | -.34 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
 All G values are also incremental.

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| | | | |
|------------------------|-----------------------|--|--|
| TABLE III - continued | | L-19A HIGH FLOTATION TIRE OBSTACLE LOADS | |
| L-19A Ground Tests | S/N 51-7441 | Data Request No. L-19-5 | |
| Obstacle Height 2 1/8" | Tire Pressure 4.9 psi | | |

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24545 | | | | | | | |
| Prior to obstacle | 0 | 630 | -230 | | | | 23.4 |
| Initial Drag Strut Axial Load | .023 | 270 | 360 | | -.05 | | |
| Drag Strut Axial Load, Springback | .049 | -60 | -1110 | | .64 | | |
| Drag Strut Axial Load, 2nd cycle | .078 | -175 | 645 | | -.11 | | |
| Maximum Vertical Load | .018 | 310 | 245 | .25 | | | |
| Vertical Load Rebound | .053 | -190 | -610 | -.37 | | | |
| Maximum Normal Acc. (Positive) | .071 | -170 | | .70 | | | |
| Maximum Normal Acc. (Negative) | .053 | -130 | | -.39 | | | |
| Maximum Longitudinal Acc. (Positive) | .045 | 60 | -760 | | 1.01 | | |
| Maximum Longitudinal Acc. (Negative) | .061 | -120 | -190 | | -.31 | | |
| Maximum Lateral Acc. (Pos., to Right) | .085 | -155 | 505 | | | .37 | |
| Maximum Lateral Acc. (Neg., to Left) | .215 | -95 | 105 | | | -.40 | |

Note: All Vertical and Drag Strut Axial Loads Tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

MODEL M-245B

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TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests

Obstacle Height 2 1/8"

S/N 51-7441

Tire Pressure 5.9 psi

Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24491 | | | | | | | |
| Prior to obstacle | 0 | 930 | -555 | | | | 14.7 |
| Initial Drag Strut Axial Load | .035 | 190 | 160 | | -.09 | | |
| Drag Strut Axial Load, Springback | .100 | 130 | -290 | | .28 | | |
| Drag Strut Axial Load, 2nd cycle | .130 | -85 | 170 | | .03 | | |
| Maximum Vertical Load | .035 | 190 | 160 | .33 | | | |
| Vertical Load Rebound | .153 | -205 | -115 | .16 | | | |
| Maximum Normal Acc. (Positive) | .090 | 45 | | .53 | | | |
| Maximum Normal Acc. (Negative) | .182 | -90 | | -.71 | | | |
| Maximum Longitudinal Acc. (Positive) | .110 | 110 | -250 | | .65 | | |
| Maximum Longitudinal Acc. (Negative) | .146 | -190 | 85 | | -.45 | | |
| Maximum Lateral Acc. (Pos., to Right) | .098 | 105 | -250 | | | .39 | |
| Maximum Lateral Acc. (Neg., to Left) | .123 | -5 | 115 | | | -.37 | |
| Oscillograph Record No. 24726 | | | | | | | |
| Prior to obstacle | 0 | 945 | -325 | | | | 25.9 |
| Initial Drag Strut Axial Load | .093 | 235 | 435 | | -.03 | | |
| Drag Strut Axial Load, Springback | .120 | 0 | -1190 | | .69 | | |
| Drag Strut Axial Load, 2nd cycle | .150 | -80 | 800 | | -.20 | | |
| Maximum Vertical Load | .035 | 360 | 295 | .17 | | | |
| Vertical Load Rebound | .130 | -180 | -160 | -.70 | | | |
| Maximum Normal Acc. (Positive) | .112 | 155 | | .74 | | | |
| Maximum Normal Acc. (Negative) | .130 | -180 | | -.70 | | | |
| Maximum Longitudinal Acc. (Positive) | .112 | 155 | -705 | | .91 | | |
| Maximum Longitudinal Acc. (Negative) | .137 | -165 | 305 | | -.54 | | |
| Maximum Lateral Acc. (Pos., to Right) | .160 | -20 | 200 | | | .77 | |
| Maximum Lateral Acc. (Neg., to Left) | .134 | 20 | -275 | | | -.56 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 2 1/8"

S/N 51-7441
Tire Pressure 5.9 psi

Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | Drag Strut
Axial Load
(lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24727 | | | | | | | |
| Prior to obstacle | 0 | 705 | -190 | | | | 35.8 |
| Initial Drag Strut Axial Load | .064 | 360 | 550 | | -.04 | | |
| Drag Strut Axial Load, Springback | .080 | -125 | -385 | | .79 | | |
| Drag Strut Axial Load, 2nd Cycle | .110 | -255 | 475 | | -.10 | | |
| Maximum Vertical Load | .056 | 425 | 220 | .25 | | | |
| Vertical Load Rebound | .110 | -255 | 475 | .25 | | | |
| Maximum Normal Acc. (Positive) | .060 | 335 | | 1.03 | | | |
| Maximum Normal Acc. (Negative) | .080 | -125 | | -.81 | | | |
| Maximum Longitudinal Acc. (Positive) | .073 | -95 | -800 | | 1.16 | | |
| Maximum Longitudinal Acc. (Negative) | .062 | 365 | 540 | | -.64 | | |
| Maximum Lateral Acc. (Pos., to Right) | .110 | -255 | 475 | | | .62 | |
| Maximum Lateral Acc. (Neg., to Left) | .086 | -175 | -540 | | | -.45 | |
| Oscillograph Record No. 24725 | | | | | | | |
| Prior to obstacle | 0 | 680 | -160 | | | | 38.7 |
| Initial Drag Strut Axial Load | .031 | 260 | 515 | | -.26 | | |
| Drag Strut Axial Load, Springback | .047 | -85 | -705 | | 1.13 | | |
| Drag Strut Axial Load, 2nd cycle | .030 | -235 | 530 | | -.33 | | |
| Maximum Vertical Load | .029 | 410 | 455 | .11 | | | |
| Vertical Load Rebound | .070 | -315 | 380 | .74 | | | |
| Maximum Normal Acc. (Positive) | .031 | 260 | | 1.03 | | | |
| Maximum Normal Acc. (Negative) | .049 | -100 | | -.95 | | | |
| Maximum Longitudinal Acc. (Positive) | .047 | -85 | -705 | | 1.13 | | |
| Maximum Longitudinal Acc. (Negative) | .036 | 320 | 315 | | -1.17 | | |
| Maximum Lateral Acc. (Pos., to Right) | .080 | -285 | 530 | | | .70 | |
| Maximum Lateral Acc. (Neg., to Left) | .057 | -180 | -590 | | | -.50 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
|---|--|-------------------------------------|--|---|--|
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|-------------------------------|--|------------------------------|--|--------------------------------|--|
| L-19A Ground Tests | | S/N <u>51-7441</u> | | Data Request No. <u>L-19-5</u> | |
| Obstacle Height <u>4 1/4"</u> | | Tire Pressure <u>2.7 psi</u> | | | |

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

| Item
(Event) | Oscillograph Record No. <u>24594</u> | Time
(Sec) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|--------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 1045 | -365 | | | | 11.5 |
| Initial Drag Strut Axial Load | | .038 | 265 | 445 | | -.08 | | |
| Drag Strut Axial Load, Springback | | .109 | -155 | -330 | | .20 | | |
| Drag Strut Axial Load, 2nd cycle | | .148 | 125 | 210 | | -.17 | | |
| Maximum Vertical Load | | .050 | 365 | 375 | .21 | | | |
| Vertical Load Rebound | | .188 | -440 | -50 | -.25 | | | |
| Maximum Normal Acc. (Positive) | | .115 | 0 | | .52 | | | |
| Maximum Normal Acc. (Negative) | | .138 | 45 | | -.35 | | | |
| Maximum Longitudinal Acc. (Positive) | | .158 | 35 | -95 | | .25 | | |
| Maximum Longitudinal Acc. (Negative) | | .222 | -255 | 280 | | -.41 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .203 | -340 | 155 | | | .59 | |
| Maximum Lateral Acc. (Neg., to Left) | | .232 | -215 | 230 | | | -.49 | |

| Item
(Event) | Oscillograph Record No. <u>24590</u> | Time
(Sec) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|--------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 1000 | -340 | | | | 12.7 |
| Initial Drag Strut Axial Load | | .038 | 140 | 290 | | -.21 | | |
| Drag Strut Axial Load, Springback | | .079 | -120 | -630 | | .37 | | |
| Drag Strut Axial Load, 2nd cycle | | .113 | 20 | 335 | | -.05 | | |
| Maximum Vertical Load | | .040 | 140 | 280 | -.12 | | | |
| Vertical Load Rebound | | .173 | -215 | 0 | .00 | | | |
| Maximum Normal Acc. (Positive) | | .166 | -185 | | .33 | | | |
| Maximum Normal Acc. (Negative) | | .146 | -135 | | -.37 | | | |
| Maximum Longitudinal Acc. (Positive) | | .079 | -120 | -630 | | .37 | | |
| Maximum Longitudinal Acc. (Negative) | | .102 | -25 | 270 | | -.29 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .177 | -185 | 70 | | | .51 | |
| Maximum Lateral Acc. (Neg., to Left) | | .293 | -40 | 60 | | | -.43 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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| <p style="text-align: center;">TABLE III - continued</p> <p style="text-align: center;"><u>L-19A HIGH FLOATION TIRE OBSTACLE LOADS</u></p> <p style="text-align: center;">L-19A Ground Tests S/N <u>51-7441</u> Data Request No. <u>L-19-5</u>
Obstacle Height <u>4 1/4"</u> Tire Pressure <u>2.7 psi</u></p> | | | | | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. <u>24595</u> | | | | | | | |
| Prior to obstacle | 0 | 880 | -250 | | | | 22.8 |
| Initial Drag Strut Axial Load | .038 | 480 | 475 | | -.24 | | |
| Drag Strut Axial Load, Springback | .098 | -245 | -1240 | | .61 | | |
| Drag Strut Axial Load, 2nd cycle | .139 | -145 | 590 | | -.64 | | |
| Maximum Vertical Load | .038 | 480 | 475 | .33 | | | |
| Vertical Load Rebound | .102 | -370 | -870 | -.99 | | | |
| Maximum Normal Acc. (Positive) | .077 | 135 | | .95 | | | |
| Maximum Normal Acc. (Negative) | .104 | -365 | | -1.13 | | | |
| Maximum Longitudinal Acc. (Positive) | .095 | -175 | -1200 | | .74 | | |
| Maximum Longitudinal Acc. (Negative) | .110 | -245 | 105 | | -.65 | | |
| Maximum Lateral Acc. (Pos., to Right) | .127 | -95 | 330 | | | .78 | |
| Maximum Lateral Acc. (Neg., to Left) | .150 | -80 | 260 | | | -.88 | |
| Oscillograph Record No. <u>24732</u> | | | | | | | |
| Prior to obstacle | 0 | 825 | -285 | | | | 24.9 |
| Initial Drag Strut Axial Load | .044 | 510 | 515 | | -.31 | | |
| Drag Strut Axial Load, Springback | .095 | -180 | -1825 | | .86 | | |
| Drag Strut Axial Load, 2nd cycle | .132 | -85 | 920 | | -.50 | | |
| Maximum Vertical Load | .044 | 510 | 515 | .17 | | | |
| Vertical Load Rebound | .100 | -320 | -1255 | -1.27 | | | |
| Maximum Normal Acc. (Positive) | .034 | 285 | | 1.21 | | | |
| Maximum Normal Acc. (Negative) | .101 | -305 | | -1.33 | | | |
| Maximum Longitudinal Acc. (Positive) | .095 | -130 | -1825 | | .86 | | |
| Maximum Longitudinal Acc. (Negative) | .109 | -235 | 0 | | -1.03 | | |
| Maximum Lateral Acc. (Pos., to Right) | .128 | -95 | 845 | | | 1.02 | |
| Maximum Lateral Acc. (Neg., to Left) | .151 | -15 | -420 | | | -.89 | |
| <p>Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.</p> <p>All G values are also incremental.</p> | | | | | | | |

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|---|--|------------|---|---------|
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| MODEL <u>M-245B</u> | PREPARED BY | CHECKED BY | APPROVED BY | |
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REVISED | |

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 4 1/4"
S/N 51-7441
Tire Pressure 2.7 psi
Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. <u>24596</u> | | | | | | | |
| Prior to obstacle | 0 | 880 | -260 | | | | 29.8 |
| Initial Drag Strut Axial Load | .028 | 485 | 580 | | -.37 | | |
| Drag Strut Axial Load, Springback | .077 | -240 | -1595 | | .96 | | |
| Drag Strut Axial Load, 2nd cycle | .116 | -165 | 695 | | -.35 | | |
| Maximum Vertical Load | .023 | 490 | 455 | .49 | | | |
| Vertical Load Rebound | .022 | -320 | -1045 | -1.11 | | | |
| Maximum Normal Acc. (Positive) | .062 | 255 | | 1.22 | | | |
| Maximum Normal Acc. (Negative) | .083 | -370 | | -1.22 | | | |
| Maximum Longitudinal Acc. (Positive) | .072 | -65 | -1375 | | 1.00 | | |
| Maximum Longitudinal Acc. (Negative) | .082 | -320 | -240 | | -.84 | | |
| Maximum Lateral Acc. (Pos., to Right) | .109 | -135 | 495 | | | .69 | |
| Maximum Lateral Acc. (Neg., to Left) | .133 | -20 | 215 | | | -.95 | |
| Oscillograph Record No. <u>24732</u> | | | | | | | |
| Prior to obstacle | 0 | 765 | -190 | | | | 37.3 |
| Initial Drag Strut Axial Load | .030 | 440 | 620 | | -.10 | | |
| Drag Strut Axial Load, Springback | .067 | -200 | -2070 | | 1.55 | | |
| Drag Strut Axial Load, 2nd cycle | .090 | -120 | 875 | | -.07 | | |
| Maximum Vertical Load | .022 | 560 | 465 | .55 | | | |
| Vertical Load Rebound | .069 | -280 | -1825 | -.38 | | | |
| Maximum Normal Acc. (Positive) | .055 | 370 | | 1.21 | | | |
| Maximum Normal Acc. (Negative) | .072 | -235 | | -1.08 | | | |
| Maximum Longitudinal Acc. (Positive) | .064 | -155 | -2035 | | 2.23 | | |
| Maximum Longitudinal Acc. (Negative) | .079 | -240 | 0 | | -1.12 | | |
| Maximum Lateral Acc. (Pos., to Right) | .102 | -125 | 715 | | | .58 | |
| Maximum Lateral Acc. (Neg., to Left) | .047 | 195 | 465 | | | -.52 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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|---|-------------|---|--|------------------------------|---------|
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LANDING GEAR TEST DATA, M-245B</u> | | | | DATE <u>January 22, 1960</u> | |
| | | | | REVISED | |

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS
L-19A Flight No. 19-15
Obstacle Size 4 1/2" S/N 51-7441
Tire Pressure 2.7 psi Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 25152 | | | | | | | |
| Prior to obstacle | 0 | 940 | -150 | | | | 30.6 |
| Initial Drag Strut Axial Load | .020 | 635 | 620 | | -.22 | | |
| Drag Strut Axial Load, Springback | .068 | -265 | -1510 | | .30 | | |
| Drag Strut Axial Load, 2nd Cycle | .104 | -20 | 940 | | -.28 | | |
| Maximum Vertical Load | .020 | 635 | 620 | .41 | | | |
| Vertical Load Rebound | .075 | -305 | -1055 | -1.43 | | | |
| Maximum Normal Acc. (Positive) | .058 | 410 | | 1.41 | | | |
| Maximum Normal Acc. (Negative) | .075 | -305 | | -1.43 | | | |
| Maximum Longitudinal Acc. (Positive) | .064 | 20 | -1000 | | .42 | | |
| Maximum Longitudinal Acc. (Negative) | .090 | -100 | 295 | | -.42 | | |
| Maximum Lateral Acc. (Pos., to Right) | .068 | -265 | -1510 | | | .75 | |
| Maximum Lateral Acc. (Neg., to Left) | .131 | 80 | -665 | | | -1.02 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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|--|--|---|--|------------------------------|
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| MODEL <u>M-245 B</u> | | OF FAIRCHILD ENGINE & AIRPLANE CORPORATION | | |
| PREPARED BY | | CHECKED BY | | APPROVED BY |
| SUBJECT:- <u>APPENDIX I</u>
<u>LANDING GEAR TEST DATA, M-245B</u> | | | | DATE <u>January 22, 1960</u> |
| | | | | REVISED |

TABLE III - continued

L-19A HIGH FLUTATION TIRE OBSTACLE LOADS

L-19A Flight No. 19-16
Obstacle Size 4-1/4"

S/N 51-7441

Tire Pressure 3.1 psi

Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) |
|--------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|------------------------------|
| Oscillograph Record No. <u>25178</u> | | | | | | | |
| Prior to obstacle | 0 | 845 | -140 | | | | 33.5 |
| Initial Drag Strut Axial Load | .055 | 225 | 710 | | -.37 | | |
| Drag Strut Axial Load, Springback | .073 | 1095 | -2230 | | 1.77 | | |
| Drag Strut Axial Load, 2nd Cycle | .105 | -40 | 1280 | | -.14 | | |
| Maximum Vertical Load | .073 | 1180 | -1840 | -.85 | | | |
| Vertical Load Rebound | .175 | -225 | 160 | +.22 | | | |
| Maximum Normal Acc. (Positive) | .067 | 660 | | +.81 | | | |
| Maximum Normal Acc. (Negative) | .080 | 1010 | | -.94 | | | |
| Maximum Longitudinal Acc. (Positive) | .073 | 1095 | -2230 | | 1.77 | | |
| Maximum Longitudinal Acc. (Negative) | .085 | 745 | -170 | | -1.01 | | |
| Maximum Lateral Acc. (Pos. to Right) | .180 | -185 | -335 | | | .44 | |
| Maximum Lateral Acc. (Neg. to Left) | .149 | -60 | 130 | | | -.44 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values. All G values are also incremental.

| | | | | | |
|--|-------------|---|--|------------------------------|---------|
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M-245B | PREPARED BY | CHECKED BY | | APPROVED BY | |
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TABLE III - continued
L-19A HIGH FLOATION TIRE OBSTACLE LOADS
 L-19A Flight No. 19-15
 Obstacle Size 4-1/4 " S/N 51-7441
 Tire Pressure 3.7 psi Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(ft/sec) |
|---------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|---------------------------------|
| Oscillograph Record No. <u>25164</u> | | | | | | | |
| Prior to obstacle | 0 | 1040 | -115 | | | | 30.5 |
| Initial Drag Strut Axial Load | .024 | 615 | 600 | | -.65 | | |
| Drag Strut Axial Load, Springback | .070 | -345 | -1965 | | 1.17 | | |
| Drag Strut Axial Load, 2nd Cycle | .104 | -165 | 1190 | | -.40 | | |
| Maximum Vertical Load | .024 | 615 | 600 | .45 | | | |
| Vertical Load Rebound | .074 | -365 | -1605 | -.58 | | | |
| Maximum Normal Acc. (Positive) | .062 | 100 | | .86 | | | |
| Maximum Normal Acc. (Negative) | .079 | -305 | | -1.16 | | | |
| Maximum Longitudinal Acc. (Positive) | .067 | -205 | -1455 | | 1.35 | | |
| Maximum Longitudinal Acc. (Negative) | .082 | -285 | -125 | | -.89 | | |
| Maximum Lateral Acc. (Pos., to Right) | .071 | -365 | -1785 | | | 1.07 | |
| Maximum Lateral Acc. (Neg., to Left) | .138 | -125 | -715 | | | -.89 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values.
 All G values are also incremental.

| | | | | | |
|--------------------|--|-------------------------------------|--|-----------------------|--|
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|------------------------|--|--|--|
| TABLE III - continued | | L-19A HIGH FLOTATION TIRE OBSTACLE LOADS | |
| L-19A Ground Tests | | S/N 51-7441 | |
| Obstacle Height 4 1/4" | | Tire Pressure 3.6 \pm .2 psi | |
| | | Data Request No. L-19-5 | |

| Item (Event) | Time (Sec.) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) |
|---------------------------------------|-------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|
| Oscillograph Record No. 24524 | | | | | | | |
| Prior to obstacle | 0 | 1045 | -445 | | | | 5.8 |
| Initial Drag Strut Axial Load | .106 | 240 | 360 | | -.09 | | |
| Drag Strut Axial Load, Springback | .239 | -60 | -610 | | .19 | | |
| Drag Strut Axial Load, 2nd cycle | .338 | -290 | 265 | | -.05 | | |
| Maximum Vertical Load | .038 | 285 | 255 | .16 | | | |
| Vertical Load Rebound | .358 | -335 | -30 | -.27 | | | |
| Maximum Normal Acc. (Positive) | .055 | 230 | | .25 | | | |
| Maximum Normal Acc. (Negative) | .313 | -295 | | -.41 | | | |
| Maximum Longitudinal Acc. (Positive) | .293 | -80 | -540 | | .33 | | |
| Maximum Longitudinal Acc. (Negative) | .100 | 260 | 340 | | -.13 | | |
| Maximum Lateral Acc. (Pos., to Right) | .115 | 215 | 255 | | | .15 | |
| Maximum Lateral Acc. (Neg., to Left) | .362 | -305 | -55 | | | -.25 | |
| Oscillograph Record No. 24510 | | | | | | | |
| Prior to obstacle | 0 | 945 | -400 | | | | 12.4 |
| Initial Drag Strut Axial Load | .030 | 185 | 315 | | .07 | | |
| Drag Strut Axial Load, Springback | .113 | 60 | -455 | | .20 | | |
| Drag Strut Axial Load, 2nd cycle | .164 | -300 | 205 | | -.16 | | |
| Maximum Vertical Load | .030 | 185 | 315 | .02 | | | |
| Vertical Load Rebound | .164 | -300 | 205 | -.23 | | | |
| Maximum Normal Acc. (Positive) | .102 | 60 | | .29 | | | |
| Maximum Normal Acc. (Negative) | .290 | -120 | | -.47 | | | |
| Maximum Longitudinal Acc. (Positive) | .110 | 60 | -405 | | .31 | | |
| Maximum Longitudinal Acc. (Negative) | .015 | 165 | 265 | | -.21 | | |
| Maximum Lateral Acc. (Pos., to Right) | .254 | -220 | 5 | | | .29 | |
| Maximum Lateral Acc. (Neg., to Left) | .123 | 45 | -165 | | | -.39 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
|---|--|--------------------------------------|--|------------------------------|--|
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| | | | | | | | |
|--|----------------|---------------------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| TABLE III - continued | | Data Request No. L-19-5 | | | | | |
| L-19A Ground Tests | | S/N 51-7441 | | | | | |
| Obstacle Height 4 1/4" | | Tire Pressure 3.6 ⁺ .2 psi | | | | | |
| L-19A HIGH FLOTATION TIRE OBSTACLE LOADS | | | | | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. 24536 | | | | | | | |
| Prior to obstacle | 0 | 1025 | -465 | | | | 12.7 |
| Initial Drag Strut Axial Load | .035 | 345 | 320 | | | | |
| Drag Strut Axial Load, Springback | .116 | 150 | -790 | | | | |
| Drag Strut Axial Load, 2nd cycle | .148 | -255 | 530 | | | | |
| Maximum Vertical Load | .040 | 385 | 370 | .16 | | | |
| Vertical Load Rebound | .165 | -460 | 190 | .02 | | | |
| Maximum Normal Acc. (Positive) | .100 | 15 | | .29 | | | |
| Maximum Normal Acc. (Negative) | .128 | 25 | | -.58 | | | |
| Maximum Longitudinal Acc. (Positive) | .107 | 85 | -695 | | .45 | | |
| Maximum Longitudinal Acc. (Negative) | .140 | -120 | 190 | | -.31 | | |
| Maximum Lateral Acc. (Pos., to Right) | .102 | 40 | -505 | | | .31 | |
| Maximum Lateral Acc. (Neg., to Left) | .136 | -55 | -85 | | | -.39 | |
| Oscillograph Record No. 24511 | | | | | | | |
| Prior to obstacle | 0 | 950 | -345 | | | | 13.4 |
| Initial Drag Strut Axial Load | .042 | 450 | 375 | | | | |
| Drag Strut Axial Load, Springback | .110 | 285 | -720 | | .07 | | |
| Drag Strut Axial Load, 2nd cycle | .153 | -160 | 245 | | -.06 | | |
| Maximum Vertical Load | .042 | 450 | 375 | .16 | | | |
| Vertical Load Rebound | .165 | -295 | 165 | .21 | | | |
| Maximum Normal Acc. (Positive) | .100 | 140 | | .52 | | | |
| Maximum Normal Acc. (Negative) | .130 | 275 | | -.27 | | | |
| Maximum Longitudinal Acc. (Positive) | .098 | 85 | -370 | | .41 | | |
| Maximum Longitudinal Acc. (Negative) | .022 | 295 | 305 | | -.24 | | |
| Maximum Lateral Acc. (Pos., to Right) | .107 | 215 | -655 | | | .49 | |
| Maximum Lateral Acc. (Neg., to Left) | .141 | 55 | -95 | | | -.51 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests

Obstacle Height 4 1/4"

S/N 51-7441

Tire Pressure 3.6 \pm .2 psi

Data Request No. L-19-5

REPORT NO. FT245-1 FAIRCHILD Aircraft and Missiles Div.
OF FAIRCHILD ENGINE & AIRPLANE CORPORATION
MODEL M-245 PREPARED BY
SUBJECT: APPENDIX I
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| Item
(Event) | Oscillograph Record No. 24539 | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|-------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 995 | -420 | | | | |
| Initial Drag Strut Axial Load | | .038 | 480 | 540 | | | | 19.1 |
| Drag Strut Axial Load, Springback | | .090 | -15 | -1140 | | -.19 | | |
| Drag Strut Axial Load, 2nd cycle | | .116 | -55 | 900 | | .29 | | |
| Maximum Vertical Load | | .030 | 520 | 435 | .31 | -.51 | | |
| Vertical Load Rebound | | .142 | -260 | -10 | -.35 | | | |
| Maximum Normal Acc. (Positive) | | .075 | 180 | | .93 | | | |
| Maximum Normal Acc. (Negative) | | .099 | -155 | | -1.05 | | | |
| Maximum Longitudinal Acc. (Positive) | | .075 | 180 | -720 | | .78 | | |
| Maximum Longitudinal Acc. (Negative) | | .116 | -55 | 900 | | -.51 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .170 | -195 | -40 | | | .56 | |
| Maximum Lateral Acc. (Neg., to Left) | | .146 | -215 | -315 | | | -.50 | |
| Prior to obstacle | | 0 | 910 | -390 | | | | |
| Initial Drag Strut Axial Load | | .020 | 525 | 550 | | | | 24.2 |
| Drag Strut Axial Load, Springback | | .073 | -240 | -1740 | | -.35 | | |
| Drag Strut Axial Load, 2nd cycle | | .102 | -80 | 950 | | .82 | | |
| Maximum Vertical Load | | .020 | 525 | 550 | .37 | .05 | | |
| Vertical Load Rebound | | .081 | -325 | -920 | -1.42 | | | |
| Maximum Normal Acc. (Positive) | | .061 | 250 | | 1.13 | | | |
| Maximum Normal Acc. (Negative) | | .081 | -325 | | -1.42 | | | |
| Maximum Longitudinal Acc. (Positive) | | .065 | 195 | -1170 | | .86 | | |
| Maximum Longitudinal Acc. (Negative) | | .083 | -275 | 75 | | -1.04 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .106 | 85 | 940 | | | .87 | |
| Maximum Lateral Acc. (Neg., to Left) | | .132 | -15 | -815 | | -1.04 | -.50 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G Values are also incremental.

| | | |
|--|--------------------|--|
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| MODEL
M-245B | PREPARED BY | CHECKED BY |
| SUBJECT:- <div style="text-align: center;"> APPENDIX I
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DATE January 22, 1960
REVISED |

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

Data Request No. L-19-5
 S/N 51-7441
 Tire Pressure 3.6⁺.2 psi

L-19A Ground Tests
 Obstacle Height 4 1/4"

Oscilloscope Record No. 24540

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | 0 | 1085 | -295 | | | | 29.0 |
| Initial Drag Strut Axial Load | .020 | 585 | 740 | | -1.45 | | |
| Drag Strut Axial Load, Springback | .057 | -230 | -2040 | | 1.34 | | |
| Drag Strut Axial Load, 2nd cycle | .103 | -155 | 1225 | | -1.51 | | |
| Maximum Vertical Load | .019 | 585 | 720 | .27 | | | |
| Vertical Load Rebound | .072 | -425 | -970 | -1.34 | | | |
| Maximum Normal Acc. (Positive) | .053 | 345 | | 1.29 | | | |
| Maximum Normal Acc. (Negative) | .074 | -395 | | -1.52 | | | |
| Maximum Longitudinal Acc. (Positive) | .055 | -20 | -1565 | | 1.16 | | |
| Maximum Longitudinal Acc. (Negative) | .080 | -275 | 125 | | -1.32 | | |
| Maximum Lateral Acc. (Pos., to Right) | .103 | -155 | 1225 | | | .92 | |
| Maximum Lateral Acc. (Neg., to Left) | .129 | 40 | -845 | | | -.92 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
 All G values are also incremental.

| | | | | | |
|---------------------------|--|-------------------------------------|--|------------------------------|----------------|
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| MODEL <u>M-245B</u> | | PREPARED BY | | APPROVED BY | |
| | | CHECKED BY | | DATE <u>January 22, 1960</u> | |
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| | | LANDING GEAR TEST DATA, M-245B | | | |

TABLE III - continued
L-19A HIGH FLUTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height $4\frac{1}{4}$ "
S/N 51-7441
Tire Pressure 4.9 psi
Data Request No. L-19-5

| Item
(Event) | Oscillograph Record No. <u>24693</u> | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|--------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 920 | -470 | | | | 9.1 |
| Initial Drag Strut Axial Load | | .040 | 365 | 325 | | -.14 | | |
| Drag Strut Axial Load, Springback | | .164 | -100 | -1140 | | .42 | | |
| Drag Strut Axial Load, 2nd cycle | | .192 | -275 | 605 | | -.36 | | |
| Maximum Vertical Load | | .060 | 440 | 230 | .25 | | | |
| Vertical Load Rebound | | .250 | -425 | 325 | -.17 | | | |
| Maximum Normal Acc. (Positive) | | .500 | 215 | | .40 | | | |
| Maximum Normal Acc. (Negative) | | .229 | -380 | | -.65 | | | |
| Maximum Longitudinal Acc. (Positive) | | .160 | -35 | -1120 | | .53 | | |
| Maximum Longitudinal Acc. (Negative) | | .192 | -275 | 605 | | -.36 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .193 | -295 | 535 | | | .47 | |
| Maximum Lateral Acc. (Neg., to Left) | | .219 | -390 | -325 | | | -.22 | |
| Oscillograph Record No. <u>24575</u> | | | | | | | | |
| Prior to obstacle | | 0 | 965 | -335 | | | | 12.8 |
| Initial Drag Strut Axial Load | | .045 | 545 | 430 | | -.03 | | |
| Drag Strut Axial Load, Springback | | .128 | -45 | -1745 | | .58 | | |
| Drag Strut Axial Load, 2nd cycle | | .155 | -335 | 1130 | | -.67 | | |
| Maximum Vertical Load | | .055 | 585 | 365 | .25 | | | |
| Vertical Load Rebound | | .236 | -450 | 10 | -.16 | | | |
| Maximum Normal Acc. (Positive) | | .161 | -400 | | .66 | | | |
| Maximum Normal Acc. (Negative) | | .192 | -315 | | -1.09 | | | |
| Maximum Longitudinal Acc. (Positive) | | .121 | 185 | -1390 | | .89 | | |
| Maximum Longitudinal Acc. (Negative) | | .155 | -335 | 1130 | | -.67 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .162 | -410 | 910 | | | .54 | |
| Maximum Lateral Acc. (Neg., to Left) | | .285 | -235 | 365 | | | -.42 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 4 1/4"
S/N 51-7441
Tire Pressure 4.9 psi
Data Request No. L-19-5

| Item
(Event) | Oscillograph Record No. 24597 | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|-------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 950 | -385 | | | | 14.1 |
| Initial Drag Strut Axial Load | | .085 | 185 | 430 | | -.09 | | |
| Drag Strut Axial Load, Springback | | .116 | -205 | -1839 | | .80 | | |
| Drag Strut Axial Load, 2nd cycle | | .148 | -385 | 1325 | | -.26 | | |
| Maximum Vertical Load | | .050 | 460 | 325 | .02 | | | |
| Vertical Load Rebound | | .165 | -410 | -345 | -.40 | | | |
| Maximum Normal Acc. (Positive) | | .148 | -385 | | .50 | | | |
| Maximum Normal Acc. (Negative) | | .122 | -325 | | -1.07 | | | |
| Maximum Longitudinal Acc. (Positive) | | .112 | -105 | -1715 | | .88 | | |
| Maximum Longitudinal Acc. (Negative) | | .143 | -370 | 1275 | | -.66 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .151 | -390 | 1140 | | | .64 | |
| Maximum Lateral Acc. (Neg., to Left) | | .173 | -260 | -865 | | | -.39 | |
| Oscillograph Record No. 24572 | | | | | | | | |
| Prior to obstacle | | 0 | 920 | -315 | | | | 23.4 |
| Initial Drag Strut Axial Load | | .063 | 410 | 585 | | -.20 | | |
| Drag Strut Axial Load, Springback | | .085 | -300 | -2520 | | 1.44 | | |
| Drag Strut Axial Load, 2nd cycle | | .116 | -185 | 1400 | | -.26 | | |
| Maximum Vertical Load | | .035 | 750 | 510 | .49 | | | |
| Vertical Load Rebound | | .090 | -420 | -1725 | -1.44 | | | |
| Maximum Normal Acc. (Positive) | | .075 | 275 | | 1.24 | | | |
| Maximum Normal Acc. (Negative) | | .092 | -385 | | -1.63 | | | |
| Maximum Longitudinal Acc. (Positive) | | .082 | -65 | -2245 | | 1.65 | | |
| Maximum Longitudinal Acc. (Negative) | | .098 | -340 | 155 | | -1.02 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .118 | -175 | 1350 | | | 1.10 | |
| Maximum Lateral Acc. (Neg., to Left) | | .140 | -25 | -1090 | | | -1.19 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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|---------------------------|--|-------------------------------------|--|------------------------------|--|-------------|--|
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|------------------------|--|--|--|
| TABLE III - continued | | L-19A HIGH FLOTATION TIRE OBSTACLE LOADS | |
| L-19A Ground Tests | | S/N 51-7441 | |
| Obstacle Height 6 3/8" | | Tire Pressure 2.7 psi | |
| | | Data Request No. L-19-5 | |

| Item
(Event) | Oscillograph Record No. 24610 | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|-------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 1015 | -395 | | | | 3.2 |
| Initial Drag Strut Axial Load | | .175 | 265 | 410 | | -.15 | | |
| Drag Strut Axial Load, Springback | | .488 | -105 | -480 | | .19 | | |
| Drag Strut Axial Load, 2nd cycle | | .792 | -295 | 50 | | -.05 | | |
| Maximum Vertical Load | | .147 | 285 | 315 | .12 | | | |
| Vertical Load Rebound | | .792 | -295 | 50 | -.04 | | | |
| Maximum Normal Acc. (Positive) | | .102 | 185 | | .21 | | | |
| Maximum Normal Acc. (Negative) | | .507 | -80 | | -.17 | | | |
| Maximum Longitudinal Acc. (Positive) | | .579 | -105 | 210 | | .20 | | |
| Maximum Longitudinal Acc. (Negative) | | .085 | 160 | 335 | | -.27 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .255 | 155 | 365 | | | .25 | |
| Maximum Lateral Acc. (Neg., to Left) | | .857 | -145 | -20 | | | -.20 | |
| Prior to obstacle | | 0 | 950 | -355 | | | | 7.7 |
| Initial Drag Strut Axial Load | | .042 | 195 | 480 | | -.27 | | |
| Drag Strut Axial Load, Springback | | .212 | 100 | -775 | | .24 | | |
| Drag Strut Axial Load, 2nd cycle | | .263 | -340 | 355 | | -.09 | | |
| Maximum Vertical Load | | .063 | 425 | 305 | .37 | | | |
| Vertical Load Rebound | | .325 | -470 | 125 | -.29 | | | |
| Maximum Normal Acc. (Positive) | | .059 | 380 | | .48 | | | |
| Maximum Normal Acc. (Negative) | | .306 | -440 | | -.56 | | | |
| Maximum Longitudinal Acc. (Positive) | | .201 | 95 | -545 | | .45 | | |
| Maximum Longitudinal Acc. (Negative) | | .044 | 215 | 470 | | -.31 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .253 | -260 | 270 | | | .38 | |
| Maximum Lateral Acc. (Neg., to Left) | | .229 | -75 | -510 | | | -.23 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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TABLE III - continued
L-19A HIGH FLOATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 6 3/8" S/N 51-7441
Tire Pressure 2.7 psi Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24612 | | | | | | | |
| Prior to obstacle | 0 | 1000 | -325 | | | | 12.3 |
| Initial Drag Strut Axial Load | .053 | 605 | 700 | | -.12 | | |
| Drag Strut Axial Load, Springback | .142 | 280 | -805 | | .39 | | |
| Drag Strut Axial Load, 2nd cycle | .219 | -425 | 220 | | -.18 | | |
| Maximum Vertical Load | .080 | 680 | 620 | .27 | | | |
| Vertical Load Rebound | .215 | -480 | 180 | -.29 | | | |
| Maximum Normal Acc. (Positive) | .130 | 305 | | .73 | | | |
| Maximum Normal Acc. (Negative) | .144 | 280 | | -.37 | | | |
| Maximum Longitudinal Acc. (Positive) | .099 | 315 | -200 | | .55 | | |
| Maximum Longitudinal Acc. (Negative) | .047 | 465 | 650 | | -.50 | | |
| Maximum Lateral Acc. (Pos., to Right) | .213 | -470 | 180 | | | .54 | |
| Maximum Lateral Acc. (Neg., to Left) | .080 | 680 | 620 | | | -.24 | |
| Oscillograph Record No. 24615 | | | | | | | |
| Prior to obstacle | 0 | 885 | -325 | | | | 19.1 |
| Initial Drag Strut Axial Load | .033 | 500 | 730 | | -.47 | | |
| Drag Strut Axial Load, Springback | .105 | 285 | -1140 | | .24 | | |
| Drag Strut Axial Load, 2nd cycle | .172 | -335 | 615 | | -.42 | | |
| Maximum Vertical Load | .049 | 720 | 680 | .10 | | | |
| Vertical Load Rebound | .160 | -440 | 200 | -.37 | | | |
| Maximum Normal Acc. (Positive) | .092 | 275 | | 1.25 | | | |
| Maximum Normal Acc. (Negative) | .121 | -275 | | -1.14 | | | |
| Maximum Longitudinal Acc. (Positive) | .093 | 245 | -740 | | 1.38 | | |
| Maximum Longitudinal Acc. (Negative) | .132 | -360 | 325 | | -.61 | | |
| Maximum Lateral Acc. (Pos., to Right) | .243 | -275 | 295 | | | .78 | |
| Maximum Lateral Acc. (Neg., to Left) | .127 | -365 | 75 | | | -.77 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 6 3/8" S/N 51-7441
Tire Pressure 2.7 psi Data Request No. L-19-5

| Item
(Event) | Oscillograph Record No. 24682 | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|-------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 945 | -310 | | | | 21.6 |
| Initial Drag Strut Axial Load | | .030 | 785 | 940 | | -.45 | | |
| Drag Strut Axial Load, Springback | | .095 | 130 | -1810 | | .69 | | |
| Drag Strut Axial Load, 2nd cycle | | .120 | -245 | 910 | | -.46 | | |
| Maximum Vertical Load | | .035 | 840 | 820 | .38 | | | |
| Vertical Load Rebound | | .108 | -455 | -490 | -1.70 | | | |
| Maximum Normal Acc. (Positive) | | .077 | 250 | | 1.09 | | | |
| Maximum Normal Acc. (Negative) | | .103 | -295 | | -1.97 | | | |
| Maximum Longitudinal Acc. (Positive) | | .080 | 265 | -950 | | 1.23 | | |
| Maximum Longitudinal Acc. (Negative) | | .141 | -320 | 555 | | -.69 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .225 | -320 | 310 | | | .94 | |
| Maximum Lateral Acc. (Neg., to Left) | | .252 | -185 | -255 | | | -.70 | |
| | | | | | | | | |
| Prior to obstacle | Oscillograph Record No. 24616 | 0 | 960 | -295 | | | | 22.4 |
| Initial Drag Strut Axial Load | | .036 | 780 | 920 | | -.39 | | |
| Drag Strut Axial Load, Springback | | .097 | 125 | -1420 | | .57 | | |
| Drag Strut Axial Load, 2nd cycle | | .153 | -245 | 815 | | -.49 | | |
| Maximum Vertical Load | | .037 | 805 | 890 | .52 | | | |
| Vertical Load Rebound | | .108 | -465 | -920 | -1.37 | | | |
| Maximum Normal Acc. (Positive) | | .082 | 255 | | 1.29 | | | |
| Maximum Normal Acc. (Negative) | | .105 | -400 | | -1.96 | | | |
| Maximum Longitudinal Acc. (Positive) | | .081 | 195 | -545 | | .85 | | |
| Maximum Longitudinal Acc. (Negative) | | .146 | -335 | 595 | | -.88 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .227 | -315 | 190 | | | .93 | |
| Maximum Lateral Acc. (Neg., to Left) | | .155 | -235 | 815 | | | -.81 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Height 6 3/8" S/N 51-7441
Tire Pressure 27 psi Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24617 | | | | | | | |
| Prior to obstacle | 0 | 750 | -250 | | | | 26.6 |
| Initial Drag Strut Axial Load | .063 | 275 | 920 | | -.36 | | |
| Drag Strut Axial Load, Springback | .094 | -245 | -1975 | | .26 | | |
| Drag Strut Axial Load, 2nd cycle | .133 | -260 | 855 | | -.53 | | |
| Maximum Vertical Load | .038 | 725 | 775 | .33 | | | |
| Vertical Load Rebound | .113 | -385 | 250 | .02 | | | |
| Maximum Normal Acc. (Positive) | .077 | 320 | | 1.05 | | | |
| Maximum Normal Acc. (Negative) | .094 | -255 | | -1.27 | | | |
| Maximum Longitudinal Acc. (Positive) | .086 | 60 | -1465 | | 1.49 | | |
| Maximum Longitudinal Acc. (Negative) | .108 | -345 | -125 | | -.69 | | |
| Maximum Lateral Acc. (Pos., to Right) | .121 | -340 | 440 | | | .82 | |
| Maximum Lateral Acc. (Neg., to Left) | .104 | -325 | -555 | | | -.66 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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| <p style="text-align: center;">TABLE III - continued</p> <p style="text-align: center;">L-19A HIGH FLOTATION TIRE OBSTACLE LOADS</p> <p style="text-align: center;">S/N 51-7441</p> <p style="text-align: center;">Tire Pressure 2.7 psi</p> <p style="text-align: center;">Data Request No. L-19-5</p> <p style="text-align: center;">L-19A Flight No. 19-15</p> <p style="text-align: center;">Obstacle Size 6-3/8"</p> | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | Drag Strut
Axial Load
(lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. 25154 | | | | | | | |
| Prior to obstacle | 0 | 1040 | -265 | | | | 10.3 |
| Initial Drag Strut Axial Load | .035 | 450 | 540 | | -.24 | | |
| Drag Strut Axial Load, Springback | .153 | 125 | -1190 | | .57 | | |
| Drag Strut Axial Load, 2nd Cycle | .190 | -345 | 740 | .32 | -.36 | | |
| Maximum Vertical Load | .052 | 635 | 370 | | | | |
| Vertical Load Rebound | .230 | -530 | -255 | -.71 | | | |
| Maximum Normal Acc. (Positive) | .119 | 225 | | .29 | | | |
| Maximum Normal Acc. (Negative) | .230 | -490 | | -.71 | | | |
| Maximum Longitudinal Acc. (Positive) | .151 | 165 | -1160 | | .63 | | |
| Maximum Longitudinal Acc. (Negative) | .190 | -345 | 740 | | -.40 | | |
| Maximum Lateral Acc. (Pos., to Right) | .200 | -470 | 475 | | | .47 | |
| Maximum Lateral Acc. (Neg., to Left) | .445 | 0 | -30 | | | -.28 | |
| Oscillograph Record No. 25156 | | | | | | | |
| Prior to obstacle | 0 | 900 | -115 | | | | 37.1 |
| Initial Drag Strut Axial Load | .029 | 735 | 770 | | -.48 | | |
| Drag Strut Axial Load, Springback | .075 | -325 | -2245 | | .57 | | |
| Drag Strut Axial Load, 2nd Cycle | .109 | -205 | 865 | | -.48 | | |
| Maximum Vertical Load | .031 | 755 | 760 | .41 | | | |
| Vertical Load Rebound | .095 | -470 | 485 | .15 | | | |
| Maximum Normal Acc. (Positive) | .068 | 205 | | 1.13 | | | |
| Maximum Normal Acc. (Negative) | .075 | -325 | | -1.41 | | | |
| Maximum Longitudinal Acc. (Positive) | .070 | 60 | -1835 | | 2.00 | | |
| Maximum Longitudinal Acc. (Negative) | .068 | -350 | -465 | | -1.07 | | |
| Maximum Lateral Acc. (Pos., to Right) | .118 | -40 | 590 | | | .85 | |
| Maximum Lateral Acc. (Neg., to Left) | .147 | -40 | -485 | | | -1.08 | |
| <p>Note: All Vertical and Drag Strut Axial Loads tabulated are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values.</p> <p>All G values are also incremental.</p> | | | | | | | |

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TABLE III - continued

L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

S/N 51-7441

Tire Pressure 3.2 psi

Data Request No. L-19-5

L-19A Flight No. 19-16

Obstacle Size 6-3/8"

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) |
|--------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|------------------------------|
| <u>Oscillograph Record No. 25179</u> | | | | | | | |
| Prior to obstacle | 0 | 930 | -140 | | | | 36.4 |
| Initial Drag Strut Axial Load | .031 | 825 | 775 | | -1.21 | | |
| Drag Strut Axial Load, Springback | .075 | -310 | -2490 | | 1.46 | | |
| Drag Strut Axial Load, 2nd Cycle | .115 | -145 | 960 | | -1.58 | | |
| Maximum Vertical Load | .035 | 845 | 735 | .52 | | | |
| Vertical Load Rebound | .038 | -560 | 130 | -1.28 | | | |
| Maximum Normal Acc. (Positive) | .066 | -475 | | 1.18 | | | |
| Maximum Normal Acc. (Negative) | .080 | -455 | | -1.16 | | | |
| Maximum Longitudinal Acc. (Pos.) | .075 | -310 | -2490 | | 1.46 | | |
| Maximum Longitudinal Acc. (Neg.) | .088 | -560 | 130 | | -1.38 | | |
| Maximum Lateral Acc. (Pos. to Right) | .102 | -290 | 605 | | | .70 | |
| Maximum Lateral Acc. (Neg. to Left) | .140 | 0 | -1055 | | | -1.90 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values. All G values are also incremental.

MODEL M-245B

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TABLE III - continued
L-19A HIGH FLUTATION TIRE OBSTACLE LOADSL-19A Ground Tests
Obstacle Heights 6 3/8"

S/N 51-7441

Tire Pressure 3.6 \pm .2 psi

Data Request No. L-19-5

| Item
(Event) | Oscillograph Record No. <u>24694</u> | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|--------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 1015 | -430 | | | | 8.5 |
| Initial Drag Strut Axial Load | | .107 | 370 | 535 | | -.18 | | |
| Drag Strut Axial Load, Springback | | .260 | -335 | -920 | | .35 | | |
| Drag Strut Axial Load, 2nd cycle | | .288 | -365 | 230 | | -.14 | | |
| Maximum Vertical Load | | .095 | 370 | 470 | .15 | | | |
| Vertical Load Rebound | | .358 | -705 | 180 | -.55 | | | |
| Maximum Normal Acc. (Positive) | | .610 | 235 | | .61 | | | |
| Maximum Normal Acc. (Negative) | | .320 | -460 | | -.65 | | | |
| Maximum Longitudinal Acc. (Positive) | | .260 | -335 | -920 | | .35 | | |
| Maximum Longitudinal Acc. (Negative) | | .182 | 145 | 500 | | -.28 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .271 | -380 | -395 | | | .40 | |
| Maximum Lateral Acc. (Neg., to Left) | | .419 | -360 | 95 | | | -.38 | |
| Oscillograph Record No. <u>24693</u> | | | | | | | | |
| Prior to obstacle | | 0 | 1000 | -335 | | | | 9.9 |
| Initial Drag Strut Axial Load | | .040 | 380 | 490 | | -.31 | | |
| Drag Strut Axial Load, Springback | | .174 | -115 | -1420 | | .51 | | |
| Drag Strut Axial Load, 2nd cycle | | .207 | -440 | 995 | | -.57 | | |
| Maximum Vertical Load | | .067 | 565 | 440 | .19 | | | |
| Vertical Load Rebound | | .275 | -500 | 545 | -.21 | | | |
| Maximum Normal Acc. (Positive) | | .545 | 260 | | .48 | | | |
| Maximum Normal Acc. (Negative) | | .230 | -430 | | -.74 | | | |
| Maximum Longitudinal Acc. (Positive) | | .170 | -5 | -1380 | | .65 | | |
| Maximum Longitudinal Acc. (Negative) | | .207 | -440 | 995 | | -.57 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .210 | -450 | 845 | | | .53 | |
| Maximum Lateral Acc. (Neg., to Left) | | .310 | -400 | -250 | | | -.27 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

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|---|-------------|--------------------------------------|-----------------------|-------|---------|
| MODEL | PREPARED BY | DESIGNED BY | APPROVED BY | | |
| M-245B | | | DATE January 22, 1960 | | |
| SUBJECT: APPENDIX I
LANDING GEAR TEST DATA, M-245B | | | REVISED | | |

| TABLE III - continued | | | | | | | | |
|--|-------------------------------|--------------------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|
| L-19A HIGH FLOTATION TIRE OBSTACLE LOADS | | | | | | | | |
| L-19A Ground Tests | | S/N 51-7441 | | Data Request No. L-19-5 | | | | |
| Obstacle Height 6 3/8" | | Tire Pressure 3.6±.2 psi | | | | | | |
| Item (Event) | Oscillograph Record No. 24626 | Time (Sec.) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) |
| Prior to obstacle | | 0 | 1145 | -375 | | | | 11.5 |
| Initial Drag Strut Axial Load | | .035 | 360 | 490 | | -.14 | | |
| Drag Strut Axial Load, Springback | | .142 | -215 | -1820 | | .62 | | |
| Drag Strut Axial Load, 2nd cycle | | .172 | -570 | 1035 | | -.68 | | |
| Maximum Vertical Load | | .050 | 440 | 385 | .27 | | | |
| Vertical Load Rebound | | .255 | -635 | 280 | -.08 | | | |
| Maximum Normal Acc. (Positive) | | .078 | -625 | | .40 | | | |
| Maximum Normal Acc. (Negative) | | .150 | -465 | | -1.05 | | | |
| Maximum Longitudinal Acc. (Positive) | | .132 | 45 | -1380 | | .80 | | |
| Maximum Longitudinal Acc. (Negative) | | .172 | -570 | 1085 | | -.63 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .078 | -625 | 900 | | | .90 | |
| Maximum Lateral Acc. (Neg., to Left) | | .205 | -550 | -845 | | | -.51 | |
| Oscillograph Record No. 24634 | | | | | | | | |
| Prior to obstacle | | 0 | 1015 | -360 | | | | 15.0 |
| Initial Drag Strut Axial Load | | .030 | 550 | 545 | | -.20 | | |
| Drag Strut Axial Load, Springback | | .113 | 250 | -1555 | | .58 | | |
| Drag Strut Axial Load, 2nd cycle | | .137 | -285 | 925 | | -.51 | | |
| Maximum Vertical Load | | .040 | 655 | 510 | .35 | | | |
| Vertical Load Rebound | | .147 | -495 | 470 | .27 | | | |
| Maximum Normal Acc. (Positive) | | .140 | -340 | | .61 | | | |
| Maximum Normal Acc. (Negative) | | .175 | -300 | | -.99 | | | |
| Maximum Longitudinal Acc. (Positive) | | .103 | 320 | -1345 | | .76 | | |
| Maximum Longitudinal Acc. (Negative) | | .137 | -285 | 925 | | -.51 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .147 | 35 | 470 | | | .80 | |
| Maximum Lateral Acc. (Neg., to Left) | | .127 | -200 | -130 | | | -.43 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | |
|---|---|------------|------------------------------|
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OF FAIRCHILD ENGINE & AIRPLANE CORPORATION | | PAGES <u>44</u> |
| MODEL <u>M-245B</u> | PREPARED BY | CHECKED BY | APPROVED BY |
| SUBJECT: - <u>APPENDIX I</u>
<u>LANDING GEAR TEST DATA, M-245B</u> | | | DATE <u>January 22, 1960</u> |
| | | | REVISED |

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS
S/N 51-7441
Tire Pressure 2.7 psi
Data Request No. L-19-5

L-19A Ground Tests
Obstacle Height 8"

| * Item
(Event) | Oscillograph Record No. 24636 | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|-------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to obstacle | | 0 | 965 | -130 | | | | 2.4 |
| Initial Drag Strut Axial Load | | .245 | 55 | 510 | | -.11 | | |
| Drag Strut Axial Load, Springback | | .840 | -355 | -130 | | .20 | | |
| Drag Strut Axial Load, 2nd cycle | | 1.000 | 75 | 21 | | .00 | | |
| Maximum Vertical Load | | .245 | 55 | 310 | .15 | | | |
| Vertical Load Rebound | | .940 | 5 | -120 | -.37 | | | |
| Maximum Normal Acc. (Positive) | | .215 | 40 | | .17 | | | |
| Maximum Normal Acc. (Negative) | | .955 | -635 | | -.40 | | | |
| Maximum Longitudinal Acc. (Positive) | | .730 | 90 | -435 | | .23 | | |
| Maximum Longitudinal Acc. (Negative) | | .290 | 15 | 470 | | -.14 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .405 | 290 | 435 | | | .23 | |
| Maximum Lateral Acc. (Neg., to Left) | | .980 | -635 | -160 | | | -.26 | |
| Oscillograph Record No. 24637 | | | | | | | | |
| Prior to obstacle | | 0 | 1170 | -255 | | | | 2.5 |
| Initial Drag Strut Axial Load | | .196 | 210 | 490 | | -.14 | | |
| Drag Strut Axial Load, Springback | | .635 | -445 | -535 | | .13 | | |
| Drag Strut Axial Load, 2nd cycle | | .905 | -435 | -75 | | .04 | | |
| Maximum Vertical Load | | .165 | 250 | 415 | .15 | | | |
| Vertical Load Rebound | | .770 | -630 | -330 | -.19 | | | |
| Maximum Normal Acc. (Positive) | | .150 | 190 | | .17 | | | |
| Maximum Normal Acc. (Negative) | | .710 | -620 | | -.21 | | | |
| Maximum Longitudinal Acc. (Positive) | | .645 | -470 | -500 | | .20 | | |
| Maximum Longitudinal Acc. (Negative) | | .305 | 35 | 445 | | -.13 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .245 | 145 | 385 | | | .27 | |
| Maximum Lateral Acc. (Neg., to Left) | | .815 | -640 | -275 | | | -.23 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
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| MODEL | M-245B | PREPARED BY | CHECKED BY | APPROVED BY | |
| SUBJECT:- APPENDIX I
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| | | | | REVISED | |

| TABLE III - continued | | | | | | | | | |
|--|-------------------------------|----------------|----------------------------|------------------------------------|-------------------------|-------------------------|-----------------------|----------------|--|
| L-19A HIGH FLOTATION TIRE OBSTACLE LOADS | | | | | | | | | |
| L-19A Ground Tests
Obstacle Height 8" | | S/N 51-7441 | | Tire Pressure 2.7 psi | | Data Request No. L-19-5 | | | |
| Item
(Event) | Oscillograph Record No. 24660 | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) | |
| Prior to obstacle | | 0 | 1205 | -235 | | | | 4.1 | |
| Initial Drag Strut Axial Load | | .185 | 380 | 585 | | -.09 | | | |
| Drag Strut Axial Load, Springback | | .415 | -615 | -460 | | .09 | | | |
| Drag Strut Axial Load, 2nd cycle | | .472 | -735 | -45 | | .00 | | | |
| Maximum Vertical Load | | .165 | 410 | 490 | .27 | | | | |
| Vertical Load Rebound | | .505 | -770 | -235 | -.49 | | | | |
| Maximum Normal Acc. (Positive) | | .750 | 340 | | .64 | | | | |
| Maximum Normal Acc. (Negative) | | .460 | -770 | | -.52 | | | | |
| Maximum Longitudinal Acc. (Positive) | | .750 | 340 | -320 | | .23 | | | |
| Maximum Longitudinal Acc. (Negative) | | .185 | 380 | 585 | | -.09 | | | |
| Maximum Lateral Acc. (Pos., to Right) | | .320 | -90 | -130 | | | .31 | | |
| Maximum Lateral Acc. (Neg., to Left) | | .655 | -95 | -225 | | | -.41 | | |
| Oscillograph Record No. 24677 | | | | | | | | | |
| Prior to obstacle | | 0 | 1062 | -360 | | | | 5.3 | |
| Initial Drag Strut Axial Load | | .067 | 315 | 460 | | -.14 | | | |
| Drag Strut Axial Load, Springback | | .315 | -345 | -1045 | | .31 | | | |
| Drag Strut Axial Load, 2nd cycle | | .350 | -345 | 375 | | -.19 | | | |
| Maximum Vertical Load | | .120 | 455 | 395 | .27 | | | | |
| Vertical Load Rebound | | .410 | -700 | 1270 | -.48 | | | | |
| Maximum Normal Acc. (Positive) | | .660 | 280 | | .63 | | | | |
| Maximum Normal Acc. (Negative) | | .395 | -625 | | -.50 | | | | |
| Maximum Longitudinal Acc. (Positive) | | .305 | -280 | 75 | | .41 | | | |
| Maximum Longitudinal Acc. (Negative) | | .350 | -345 | 375 | | -.19 | | | |
| Maximum Lateral Acc. (Pos., to Right) | | .402 | -680 | 55 | | | .41 | | |
| Maximum Lateral Acc. (Neg., to Left) | | .680 | 340 | 340 | | | -.27 | | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
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| SUBJECT: <u>APPENDIX I</u> | | CHECKED BY | | DATE <u>January 22, 1960</u> | |
| SUBJECT: <u>LANDING GEAR TEST DATA, M-245B</u> | | | | REVISED | |

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS
 L-19A Ground Tests
 Obstacle Height 8"
 S/N 51-7441
 Tire Pressure 2.7 psi
 Data Request No. L-19-5

| Item (Event) | Oscillograph Record No. 24673 | Time (Sec.) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) |
|---------------------------------------|-------------------------------|-------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|
| Prior to obstacle | | 0 | 1030 | -395 | | | | 5.3 |
| Initial Drag Strut Axial Load | | .230 | 80 | 610 | | -.15 | | |
| Drag Strut Axial Load, Springback | | .312 | -275 | -1055 | | .42 | | |
| Drag Strut Axial Load, 2nd cycle | | .350 | -320 | 300 | | -.22 | | |
| Maximum Vertical Load | | .120 | 445 | 460 | .25 | | | |
| Vertical Load Rebound | | .412 | -615 | 140 | -.48 | | | |
| Maximum Normal Acc. (Positive) | | .670 | 350 | | .61 | | | |
| Maximum Normal Acc. (Negative) | | .440 | -510 | | -.53 | | | |
| Maximum Longitudinal Acc. (Positive) | | .305 | 450 | -930 | | .53 | | |
| Maximum Longitudinal Acc. (Negative) | | .345 | -315 | 225 | | -.24 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .162 | 300 | 310 | | | .36 | |
| Maximum Lateral Acc. (Neg., to Left) | | .675 | 335 | -170 | | | -.31 | |
| Prior to obstacle | | 0 | 920 | -360 | | | | 6.0 |
| Initial Drag Strut Axial Load | | .050 | 285 | 510 | | -.28 | | |
| Drag Strut Axial Load, Springback | | .265 | 25 | -525 | | .25 | | |
| Drag Strut Axial Load, 2nd cycle | | .390 | -655 | 350 | | -.17 | | |
| Maximum Vertical Load | | .100 | 485 | 340 | .27 | | | |
| Vertical Load Rebound | | .375 | -795 | 235 | -.69 | | | |
| Maximum Normal Acc. (Positive) | | .110 | 475 | | .29 | | | |
| Maximum Normal Acc. (Negative) | | .400 | -580 | | -.71 | | | |
| Maximum Longitudinal Acc. (Positive) | | .265 | 25 | -525 | | .65 | | |
| Maximum Longitudinal Acc. (Negative) | | .045 | 265 | 500 | | -.29 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .295 | -145 | -415 | | | .35 | |
| Maximum Lateral Acc. (Neg., to Left) | | .510 | -205 | 000 | | | -.29 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
 All G values are also incremental.

| | | | | | |
|---------------------------|--|--|--|------------------------------|----------------|
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| SUBJECT:-- | | APPENDIX I
LANDING GEAR TEST DATA, M-245B | | DATE <u>January 22, 1960</u> | |
| | | | | REVISED | |

TABLE III - continued
L-19A HIGH FLOTATION TIRE OBSTACLE LOADS

L-19A Ground Tests
Obstacle Heights 8"
S/N 51-7441
Tire Pressure 2.7 psi
Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. <u>24650</u> | | | | | | | |
| Prior to obstacle | 0 | 880 | -385 | | | | 7.0 |
| Initial Drag Strut Axial Load | .043 | 295 | 445 | | -.30 | | |
| Drag Strut Axial Load, Springback | .255 | -150 | -585 | | .28 | | |
| Drag Strut Axial Load, 2nd cycle | .352 | -680 | 255 | | -.14 | | |
| Maximum Vertical Load | .090 | 410 | 265 | .35 | | | |
| Vertical Load Rebound | .340 | -730 | 140 | -.58 | | | |
| Maximum Normal Acc. (Positive) | .058 | 355 | | .40 | | | |
| Maximum Normal Acc. (Negative) | .385 | -485 | | -.69 | | | |
| Maximum Longitudinal Acc. (Positive) | .230 | 125 | -460 | | .34 | | |
| Maximum Longitudinal Acc. (Negative) | .043 | 230 | 435 | | -.42 | | |
| Maximum Lateral Acc. (Pos., to Right) | .275 | -195 | -310 | | | .39 | |
| Maximum Lateral Acc. (Neg., to Left) | .385 | -485 | -30 | | | -.33 | |
| Oscillograph Record No. <u>24638</u> | | | | | | | |
| Prior to obstacle | 0 | 985 | -300 | | | | 8.1 |
| Initial Drag Strut Axial Load | .055 | 420 | 755 | | -.09 | | |
| Drag Strut Axial Load, Springback | .222 | -90 | -1405 | | .54 | | |
| Drag Strut Axial Load, 2nd cycle | .263 | -470 | 705 | | -.23 | | |
| Maximum Vertical Load | .085 | 625 | 470 | .33 | | | |
| Vertical Load Rebound | .315 | -740 | 55 | -.58 | | | |
| Maximum Normal Acc. (Positive) | .070 | 530 | | .40 | | | |
| Maximum Normal Acc. (Negative) | .305 | -730 | | -.62 | | | |
| Maximum Longitudinal Acc. (Positive) | .220 | 20 | -1375 | | .62 | | |
| Maximum Longitudinal Acc. (Negative) | .260 | -430 | 670 | | -.23 | | |
| Maximum Lateral Acc. (Pos., to Right) | .260 | -430 | 670 | | | .41 | |
| Maximum Lateral Acc. (Neg., to Left) | .440 | -390 | 20 | | | -.30 | |

Note: All Vertical Loads and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
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| SUBJECT: <u>APPENDIX I</u> | | DATE <u>January 22, 1960</u> | | REVIS | |
| SUBJECT: <u>LANDING GEAR TEST DATA, M-245B</u> | | | | | |

TABLE IV
L-19A HIGH FLOTATION TIRE DITCH LOADS

L-19A Ground Tests
Ditch Size 12" wide
4" deep

S/N 51-7441
Data Request No. L-19-5
Tire Pressure 2.7 psi

| Item (Event) | Oscillograph Record No. 24641 | Time (Sec.) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. acc. (g's) | Lat. Acc. (g's) | Speed (MPH) |
|---------------------------------------|-------------------------------|-------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|
| Prior to ditch | | 0 | 695 | -245 | | | | 25.2 |
| Initial Drag Strut Axial Load | | .080 | 40 | 490 | | -.19 | | |
| Drag Strut Axial Load, Springback | | .108 | 390 | -310 | | .12 | | |
| Maximum Vertical Load | | .058 | -220 | -300 | .15 | | | |
| Vertical Load Rebound | | .100 | 400 | -205 | .29 | | | |
| Maximum Normal Acc. (Positive) | | .095 | 390 | | .60 | | | |
| Maximum Normal Acc. (Negative) | | .115 | 390 | | -.08 | | | |
| Maximum Longitudinal Acc. (Positive) | | .134 | 265 | -235 | | .26 | | |
| Maximum Longitudinal Acc. (Negative) | | .075 | -20 | 405 | | -.20 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .240 | 270 | -10 | | | .31 | |
| Maximum Lateral Acc. (Neg., to Left) | | .120 | 380 | -205 | | | -.42 | |
| Prior to ditch | | 0 | 605 | -235 | | | | 31.2 |
| Initial Drag Strut Axial Load | | .255 | -80 | 320 | | -.43 | | |
| Drag Strut Axial Load, Springback | | .285 | 240 | -225 | | .07 | | |
| Maximum Vertical Load | | .235 | -340 | 30 | -.08 | | | |
| Vertical Load Rebound | | .272 | 305 | -20 | .42 | | | |
| Maximum Normal Acc. (Positive) | | .275 | 225 | | .48 | | | |
| Maximum Normal Acc. (Negative) | | .290 | 205 | | -.27 | | | |
| Maximum Longitudinal Acc. (Positive) | | .315 | 95 | 45 | | .12 | | |
| Maximum Longitudinal Acc. (Negative) | | .255 | -80 | 320 | | -.43 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .415 | 175 | -10 | | | .26 | |
| Maximum Lateral Acc. (Neg., to Left) | | .297 | 165 | -130 | | | -.41 | |

Note: All Vertical and Drag Strut axial loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
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TABLE IV - continued
 L-19A HIGH FLOTATION TIRE DITCH LOADS
 S/N 51-7441
 L-19A Ground Tests
 Ditch Size 18" wide
 4" deep
 Tire Pressure 2.7 psi
 Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24643 | | | | | | | |
| Prior to ditch | 0 | 945 | -320 | | | | 11.1 |
| Initial Drag Strut Axial Load | .085 | -315 | 500 | | -.11 | | |
| Drag Strut Axial Load, Springback | .237 | 615 | -640 | | .23 | | |
| Maximum Vertical Load | .065 | -520 | -340 | -.27 | | | |
| Vertical Load Rebound | .215 | 825 | -300 | .54 | | | |
| Maximum Normal Acc. (Positive) | .225 | 785 | | .56 | | | |
| Maximum Normal Acc. (Negative) | .065 | -520 | | -.27 | | | |
| Maximum Longitudinal Acc. (Positive) | .235 | 695 | -555 | | .26 | | |
| Maximum Longitudinal Acc. (Negative) | .120 | -110 | 140 | | -.18 | | |
| Maximum Lateral Acc. (Pos., to Right) | .335 | 195 | -130 | | | .39 | |
| Maximum Lateral Acc. (Neg., to Left) | .220 | 785 | -255 | | | -.15 | |
| Oscillograph Record No. 24644 | | | | | | | |
| Prior to ditch | 0 | 700 | -225 | | | | 25.2 |
| Initial Drag Strut Axial Load | .072 | 445 | 480 | | -.16 | | |
| Drag Strut Axial Load, Springback | .098 | 570 | -575 | | .09 | | |
| Maximum Vertical Load | .042 | -470 | -320 | -.04 | | | |
| Vertical Load Rebound | .085 | 730 | 105 | -.02 | | | |
| Maximum Normal Acc. (Positive) | .075 | 525 | | 1.10 | | | |
| Maximum Normal Acc. (Negative) | .095 | 550 | | -.35 | | | |
| Maximum Longitudinal Acc. (Positive) | .035 | -430 | -510 | | .23 | | |
| Maximum Longitudinal Acc. (Negative) | .060 | -185 | 385 | | -.23 | | |
| Maximum Lateral Acc. (Pos., to Right) | .127 | 325 | -330 | | | .52 | |
| Maximum Lateral Acc. (Neg., to Left) | .106 | 595 | -340 | | | -.10 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
 All G values are also incremental.

| | | | | | | |
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| MODEL
M-245B | PREPARED BY | CHECKED BY | APPROVED BY | | | |
| <p style="text-align: center;">APPENDIX I</p> <p>SUBJECT:- LANDING GEAR TEST DATA, M-245B</p> | | | | | <p>DATE January 22, 1960</p> <p>REVISED</p> | |

L-19A Ground Tests
Ditch Size 18" wide
4" deep

S/N 51-7441
Tire Pressure 2.7 psi

Data Request No. **L-19-5**

TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24645 | | | | | | | |
| Prior to ditch | 0 | 600 | -190 | | | | 30.7 |
| Initial Drag Strut Axial Load | .270 | -125 | 205 | | -.09 | | |
| Drag Strut Axial Load, Springback | .290 | 220 | -265 | | -.01 | | |
| Maximum Vertical Load | .243 | -525 | 10 | -.15 | | | |
| Vertical Load Rebound | .285 | 265 | -160 | .12 | | | |
| Maximum Normal Acc. (Positive) | .335 | 50 | | .54 | | | |
| Maximum Normal Acc. (Negative) | .300 | 205 | | -.25 | | | |
| Maximum Longitudinal Acc. (Positive) | .344 | 50 | 000 | | .11 | | |
| Maximum Longitudinal Acc. (Negative) | .270 | -125 | 205 | | -.09 | | |
| Maximum Lateral Acc. (Pos., to Right) | .425 | 260 | -20 | | | .36 | |
| Maximum Lateral Acc. (Neg., to Left) | .310 | 145 | -120 | | | -.29 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
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| PREPARED BY | | CHECKED BY | | DATE January 22, 1960 | |
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LANDING GEAR TEST DATA, M-245B | | | | REVISED | |

TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS

L-19A Ground Tests
Ditch Size 24" wide
4" deep
S/N 51-7441
Tire Pressure 2.7 psi
Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24646 | | | | | | | |
| Prior to ditch | 0 | 905 | -360 | | | | 11.3 |
| Initial Drag Strut Axial Load | .260 | -5 | 425 | | -16 | | |
| Drag Strut Axial Load, Springback | .363 | 860 | -415 | | +18 | | |
| Maximum Vertical Load | .170 | -790 | -10 | -37 | | | |
| Vertical Load Rebound | .333 | 955 | -275 | +67 | | | |
| Maximum Normal Acc. (Positive) | .360 | 905 | | +71 | | | |
| Maximum Normal Acc. (Negative) | .615 | -300 | | -50 | | | |
| Maximum Longitudinal Acc. (Positive) | .370 | 825 | -360 | | +20 | | |
| Maximum Longitudinal Acc. (Negative) | .425 | 440 | -10 | | -19 | | |
| Maximum Lateral Acc. (Pos., to Right) | .537 | -170 | 55 | | | +35 | |
| Maximum Lateral Acc. (Neg., to Left) | .304 | 720 | 20 | | | -25 | |
| Oscillograph Record No. 24647 | | | | | | | |
| Prior to ditch | 0 | 870 | -330 | | | | 18.2 |
| Initial Drag Strut Axial Load | .170 | 30 | 490 | | -32 | | |
| Drag Strut Axial Load, Springback | .228 | 355 | -405 | | +15 | | |
| Maximum Vertical Load | .130 | -820 | 45 | -40 | | | |
| Vertical Load Rebound | .283 | 525 | 120 | +46 | | | |
| Maximum Normal Acc. (Positive) | .275 | 465 | | +49 | | | |
| Maximum Normal Acc. (Negative) | .115 | -750 | | -54 | | | |
| Maximum Longitudinal Acc. (Positive) | .220 | 375 | -330 | | +20 | | |
| Maximum Longitudinal Acc. (Negative) | .175 | 200 | 470 | | -34 | | |
| Maximum Lateral Acc. (Pos., to Right) | .143 | -680 | 280 | | | +30 | |
| Maximum Lateral Acc. (Neg., to Left) | .201 | 370 | -95 | | | -36 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

MODEL

M-245B

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APPENDIX I
SUBJECT:- LANDING GEAR TEST DATA, M-245B

DATE January 22, 1960

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TABLE IV - continued

L-19A HIGH FLOTATION TIRE DITCH LOADS

S/N 51-7441

Data Request No. L-19-5

Tire Pressure 2.7 psi

L-19A Ground Tests
Ditch Size 24" wide
4" deep

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24648 | | | | | | | |
| Prior to ditch | 0 | 730 | -300 | | | | 22.9 |
| Initial Drag Strut Axial Load | .117 | 355 | 545 | | -.31 | | |
| Drag Strut Axial Load, Springback | .150 | 485 | -460 | | +.23 | | |
| Maximum Vertical Load | .080 | -695 | 75 | -.46 | | | |
| Vertical Load Rebound | .130 | 605 | 300 | +.29 | | | |
| Maximum Normal Acc. (Positive) | .122 | 455 | | +.67 | | | |
| Maximum Normal Acc. (Negative) | .125 | 530 | | -.29 | | | |
| Maximum Longitudinal Acc. (Positive) | .063 | 355 | -255 | | +.29 | | |
| Maximum Longitudinal Acc. (Negative) | .117 | 355 | 545 | | -.31 | | |
| Maximum Lateral Acc. (Pos., to Right) | .102 | 375 | 290 | | | +.42 | |
| Maximum Lateral Acc. (Neg., to Left) | .150 | 485 | -460 | | | -.68 | |
| Oscillograph Record No. 24649 | | | | | | | |
| Prior to ditch | 0 | 775 | -190 | | | | 28.4 |
| Initial Drag Strut Axial Load | .098 | 655 | 510 | | +.27 | | |
| Drag Strut Axial Load, Springback | .113 | 380 | -385 | | +.22 | | |
| Maximum Vertical Load | .069 | -905 | 30 | -.37 | | | |
| Vertical Load Rebound | .095 | 1000 | 395 | +.94 | | | |
| Maximum Normal Acc. (Positive) | .097 | 640 | | +.96 | | | |
| Maximum Normal Acc. (Negative) | .117 | 375 | | -.56 | | | |
| Maximum Longitudinal Acc. (Positive) | .103 | 505 | 85 | | +.30 | | |
| Maximum Longitudinal Acc. (Negative) | .121 | 340 | -309 | | -.35 | | |
| Maximum Lateral Acc. (Pos., to Right) | .083 | -585 | 140 | | | +.40 | |
| Maximum Lateral Acc. (Neg., to Left) | .128 | 305 | -265 | | | -.77 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
|---|--------|---|------------|----------------------------------|---------|
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| | | | |
|--|--|---|--|
| TABLE IV - continued | | L-19A HIGH FLOTATION TIRE DITCH LOADS | |
| L-19A Ground Tests
Ditch Size 24" wide
4" deep | | S/N 51-7441
Tire Pressure 2.7 psi
Data Request No. L-19-5 | |

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24675 | | | | | | | |
| Prior to ditch | 0 | 645 | -235 | | | | 28.8 |
| Initial Drag Strut Axial Load | .092 | 620 | 780 | | -15 | | |
| Drag Strut Axial Load, Springback | .119 | 560 | -500 | | +12 | | |
| Maximum Vertical Load | .061 | -925 | 45 | -44 | | | |
| Vertical Load Rebound | .105 | 805 | -65 | -15 | | | |
| Maximum Normal Acc. (Positive) | .085 | -130 | | +90 | | | |
| Maximum Normal Acc. (Negative) | .112 | 715 | | -67 | | | |
| Maximum Longitudinal Acc. (Positive) | .145 | 395 | -30 | | +28 | | |
| Maximum Longitudinal Acc. (Negative) | .077 | -565 | 140 | | -22 | | |
| Maximum Lateral Acc. (Pos., to Right) | .032 | -305 | 255 | | | +57 | |
| Maximum Lateral Acc. (Neg., to Left) | .121 | 530 | -470 | | | -15 | |
| Oscillograph Record No. 24676 | | | | | | | |
| Prior to ditch | 0 | 525 | -180 | | | | 26.0 |
| Initial Drag Strut Axial Load | .250 | -435 | 160 | | +03 | | |
| Drag Strut Axial Load, Springback | .560 | 145 | -180 | | +04 | | |
| Maximum Vertical Load | .250 | -435 | 160 | -17 | | | |
| Vertical Load Rebound | .610 | 260 | -10 | +12 | | | |
| Maximum Normal Acc. (Positive) | .330 | -150 | | +17 | | | |
| Maximum Normal Acc. (Negative) | .230 | -400 | | -34 | | | |
| Maximum Longitudinal Acc. (Positive) | .550 | -45 | 45 | | +24 | | |
| Maximum Longitudinal Acc. (Negative) | .150 | -245 | 45 | | -01 | | |
| Maximum Lateral Acc. (Pos. to Right) | .258 | -320 | 85 | | | +18 | |
| Maximum Lateral Acc. (Neg., to Left) | .342 | 50 | -65 | | | -25 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

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| <div style="display: flex; justify-content: space-between;"> <div> <p>TABLE IV - continued</p> <p>L-19A HIGH FLOTATION TIRE DITCH LOADS</p> <p>L-19A Flight No. 19-15
Ditch Size 24" wide
4" deep</p> </div> <div> <p>S/N 51-7441</p> <p>Tire Pressure 2.7 psi</p> <p>Data Request No. L-19-5</p> </div> </div> | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) |
| Oscillograph Record No. 25158 | | | | | | | |
| Prior to obstacle | 0 | 1020 | -105 | | | | 31.5 |
| Initial Drag Strut Axial Load | .029 | 960 | 1055 | | -.65 | | |
| Drag Strut Axial Load, Springback | .052 | 410 | -465 | | -.06 | | |
| Maximum Vertical Load | .010 | -1000 | -65 | -.30 | | | |
| Vertical Load Rebound | .029 | 960 | 1055 | .66 | | | |
| Maximum Normal Acc. (Positive) | .080 | 185 | | .83 | | | |
| Maximum Normal Acc. (Negative) | .004 | -695 | | -.88 | | | |
| Maximum Longitudinal Acc. (Positive) | .010 | -1000 | -65 | | .18 | | |
| Maximum Longitudinal Acc. (Negative) | .029 | 960 | 1055 | | -.65 | | |
| Maximum Lateral Acc. (Pos. to Right) | .178 | 225 | -55 | | | .79 | |
| Maximum Lateral Acc. (Neg. to Left) | .061 | 410 | -255 | | | -.99 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
|---|--|-------------------------------------|------------|-----------------------|---------|
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| | | | |
|--|--|---------------------------------------|--|
| TABLE IV - continued | | L-19A HIGH FLOTATION TIRE DITCH LOADS | |
| L-19A Ground Tests
Ditch Size 12" wide
6" deep | | S/N 51-7441
Tire Pressure 2.7 psi | |
| Data Request No. L-19-5 | | | |

| Item (Event) | Oscillograph Record No. 24662 | Time (Sec.) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) |
|---------------------------------------|-------------------------------|-------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|
| Prior to ditch | | 0 | 1030 | -375 | | | | 3.2 |
| Initial Drag Strut Axial Load | | .580 | 225 | 470 | | -.13 | | |
| Drag Strut Axial Load, Springback | | .712 | 275 | -205 | | .01 | | |
| Maximum Vertical Load | | .310 | -345 | -75 | -.19 | | | |
| Vertical Load Rebound | | .620 | 390 | 85 | .21 | | | |
| Maximum Normal Acc. (Positive) | | .480 | 190 | | .25 | | | |
| Maximum Normal Acc. (Negative) | | .840 | -100 | | -.33 | | | |
| Maximum Longitudinal Acc. (Positive) | | .730 | 230 | 20 | | .04 | | |
| Maximum Longitudinal Acc. (Negative) | | .590 | 260 | 335 | | -.16 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .810 | -40 | 75 | | | .41 | |
| Maximum Lateral Acc. (Neg., to Left) | | .445 | 150 | 45 | | | -.06 | |

| Item (Event) | Oscillograph Record No. 24663 | Time (Sec.) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) |
|---------------------------------------|-------------------------------|-------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|
| Prior to ditch | | 0 | 840 | -350 | | | | 11.6 |
| Initial Drag Strut Axial Load | | .115 | 240 | 450 | | -.17 | | |
| Drag Strut Axial Load, Springback | | .192 | 735 | -470 | | .29 | | |
| Maximum Vertical Load | | .035 | -240 | -205 | -.15 | | | |
| Vertical Load Rebound | | .160 | 960 | -131 | .54 | | | |
| Maximum Normal Acc. (Positive) | | .210 | 750 | | .64 | | | |
| Maximum Normal Acc. (Negative) | | .480 | -190 | | -.45 | | | |
| Maximum Longitudinal Acc. (Positive) | | .192 | 735 | -470 | | .29 | | |
| Maximum Longitudinal Acc. (Negative) | | .110 | 125 | 330 | | -.19 | | |
| Maximum Lateral Acc. (Pos., to Right) | | .290 | 345 | 65 | | | .47 | |
| Maximum Lateral Acc. (Neg., to Left) | | .180 | 870 | -350 | | | -.29 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All C values are also incremental.

| | | | | | |
|---------------------------|--|--|--|------------------------------|---------|
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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS
S/N 51-7441
Tire Pressure 2.7 psi
Iata Request No. L-19-5
L-19A Ground Tests
Ditch Size 12" wide
6" deep

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24664 | | | | | | | |
| Prior to ditch | 0 | 860 | -320 | | | | 21.5 |
| Initial Drag Strut Axial Load | .080 | -40 | 535 | | -.21 | | |
| Drag Strut Axial Load, Springback | .115 | 315 | -350 | | .07 | | |
| Maximum Vertical Load | .035 | -340 | 85 | -.06 | | | |
| Vertical Load Rebound | .105 | 415 | -140 | -.02 | | | |
| Maximum Normal Acc. (Positive) | .093 | 260 | | .70 | | | |
| Maximum Normal Acc. (Negative) | .030 | -320 | | -.21 | | | |
| Maximum Longitudinal Acc. (Positive) | .135 | 245 | -160 | | .19 | | |
| Maximum Longitudinal Acc. (Negative) | .075 | -150 | 375 | | -.24 | | |
| Maximum Lateral Acc. (Pos., to Right) | .145 | 170 | -160 | | | .50 | |
| Maximum Lateral Acc. (Neg., to Left) | .125 | 300 | -310 | | | -.53 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

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| TABLE IV - continued | | | | | | | |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| L-19 HIGH FLOTATION TIRE DITCH LOADS | | | | | | | |
| S/N 51-7441 | | | | | | | |
| Tire Pressure 2.7 psi | | | | | | | |
| Data Request No. L-19-5 | | | | | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. 24665 | | | | | | | |
| Prior to ditch | 0 | 1205 | -275 | | | | 3.2 |
| Initial Drag Strut Axial Load | .555 | 250 | 555 | | -.16 | | |
| Drag Strut Axial Load, Springback | .710 | -15 | -140 | | -.01 | | |
| Maximum Vertical Load | .220 | -470 | -160 | -.21 | | | |
| Vertical Load Rebound | .420 | 410 | 140 | +.40 | | | |
| Maximum Normal Acc. (Positive) | .410 | 380 | | +.42 | | | |
| Maximum Normal Acc. (Negative) | .200 | -455 | | -.25 | | | |
| Maximum Longitudinal Acc. (Positive) | .210 | -455 | -140 | | +.03 | | |
| Maximum Longitudinal Acc. (Negative) | .495 | 340 | 480 | | -.19 | | |
| Maximum Lateral Acc. (Pos., to Right) | .710 | -15 | -140 | | | +.47 | |
| Maximum Lateral Acc. (Neg., to Left) | .315 | 35 | -75 | | | -.09 | |
| Oscillograph Record No. 24666 | | | | | | | |
| Prior to ditch | 0 | 915 | -330 | | | | 11.3 |
| Initial Drag Strut Axial Load | .168 | 165 | 650 | | -.23 | | |
| Drag Strut Axial Load, Springback | .265 | 965 | -660 | | +.28 | | |
| Maximum Vertical Load | .098 | -675 | -105 | -.31 | | | |
| Vertical Load Rebound | .230 | 1220 | -300 | +.83 | | | |
| Maximum Normal Acc. (Positive) | .060 | 1105 | | +.98 | | | |
| Maximum Normal Acc. (Negative) | .500 | -345 | | -.58 | | | |
| Maximum Longitudinal Acc. (Positive) | .275 | 965 | -190 | | +.29 | | |
| Maximum Longitudinal Acc. (Negative) | .160 | 5 | 520 | | -.28 | | |
| Maximum Lateral Acc. (Pos., to Right) | .522 | -390 | 95 | | | +.45 | |
| Maximum Lateral Acc. (Neg., to Left) | .230 | 1220 | -300 | | | -.39 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
|---|--------|--------------------------------------|------------|------------------------------|------|
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TABLE IV - continued
L-19 HIGH FLOTATION TIRE DITCH LOADS
S/N 51-7441
Tire Pressure 2.7 psi
Data Request No. L-19-5

L-19A Ground Tests
Ditch Size 18" wide
6" deep

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24679 | | | | | | | |
| Prior to ditch | 0 | 925 | -295 | | | | 20.7 |
| Initial Drag Strut Axial Load | .090 | 80 | 770 | | -.42 | | |
| Drag Strut Axial Load, Springback | .130 | 400 | -470 | | +.31 | | |
| Maximum Vertical Load | .055 | -820 | -385 | -.63 | | | |
| Vertical Load Rebound | .112 | 470 | 85 | -.19 | | | |
| Maximum Normal Acc. (Positive) | .090 | 80 | | +.67 | | | |
| Maximum Normal Acc. (Negative) | .055 | -820 | | -.63 | | | |
| Maximum Longitudinal Acc. (Positive) | .130 | 400 | -470 | | +.31 | | |
| Maximum Longitudinal Acc. (Negative) | .100 | 280 | 735 | | -.45 | | |
| Maximum Lateral Acc. (Pos., to Right) | .085 | -100 | 610 | | | +.48 | |
| Maximum Lateral Acc. (Neg., to Left) | .120 | 450 | -160 | | | -.56 | |
| Oscillograph Record No. 24699 | | | | | | | |
| Prior to ditch | 0 | 900 | -335 | | | | 24.1 |
| Initial Drag Strut Axial Load | .085 | 550 | 585 | | -.24 | | |
| Drag Strut Axial Load, Springback | .122 | 625 | -545 | | +.23 | | |
| Maximum Vertical Load | .045 | -645 | -400 | -.21 | | | |
| Vertical Load Rebound | .105 | 780 | 85 | +.02 | | | |
| Maximum Normal Acc. (Positive) | .133 | 530 | | +.84 | | | |
| Maximum Normal Acc. (Negative) | .045 | -645 | | -.21 | | | |
| Maximum Longitudinal Acc. (Positive) | .138 | 430 | -385 | | +.20 | | |
| Maximum Longitudinal Acc. (Negative) | .060 | -500 | 270 | | -.38 | | |
| Maximum Lateral Acc. (Pos., to Right) | .138 | 430 | -385 | | | +.56 | |
| Maximum Lateral Acc. (Neg., to Left) | .110 | 885 | -270 | | | -1.01 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
|---|--|-------------------------------------|--|------------------------------|--|
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| TABLE IV - continued | | | | | | | |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| L-19A HIGH FLOTATION TIRE DITCH LOADS | | | | | | | |
| S/N 51-7441 | | | | | | | |
| Tire Pressure 2.7 psi | | | | | | | |
| Data Request No. L-19-5 | | | | | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. 24680 | | | | | | | |
| Prior to ditch | 0 | 805 | -265 | | | | 25.0 |
| Initial Drag Strut Axial Load | .075 | 670 | 790 | | -.39 | | |
| Drag Strut Axial Load, Springback | .105 | 850 | -555 | | +.27 | | |
| Maximum Vertical Load | .038 | -525 | -545 | -.27 | | | |
| Vertical Load Rebound | .090 | 945 | -30 | +.04 | | | |
| Maximum Normal Acc. (Positive) | .072 | 730 | | +1.11 | | | |
| Maximum Normal Acc. (Negative) | .042 | -485 | | -.29 | | | |
| Maximum Longitudinal Acc. (Positive) | .128 | 590 | -425 | | +.43 | | |
| Maximum Longitudinal Acc. (Negative) | .072 | 730 | 715 | | -.41 | | |
| Maximum Lateral Acc. (Pos., to Right) | .128 | 590 | -425 | | | +.68 | |
| Maximum Lateral Acc. (Neg., to Left) | .100 | 805 | -480 | | | -.83 | |
| Oscillograph Record No. 24700 | | | | | | | |
| Prior to ditch | 0 | 925 | -260 | | | | 28.4 |
| Initial Drag Strut Axial Load | .078 | 750 | 775 | | -.42 | | |
| Drag Strut Axial Load, Springback | .105 | 920 | -500 | | +.09 | | |
| Maximum Vertical Load | .032 | -425 | 50 | -.48 | | | |
| Vertical Load Rebound | .092 | 1035 | 180 | +.83 | | | |
| Maximum Normal Acc. (Positive) | .128 | 805 | | +.99 | | | |
| Maximum Normal Acc. (Negative) | .025 | -365 | | -.50 | | | |
| Maximum Longitudinal Acc. (Positive) | .132 | 760 | -270 | | +.45 | | |
| Maximum Longitudinal Acc. (Negative) | .078 | 750 | 775 | | -.42 | | |
| Maximum Lateral Acc. (Pos., to Right) | .042 | 720 | -220 | | | +.68 | |
| Maximum Lateral Acc. (Neg., to Left) | .112 | 910 | -135 | | | -.43 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

MODEL

M-245B

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APPENDIX I

SUBJECT:-

LANDING GEAR TEST DATA, M-245B

DATE January 22, 1960

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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADSL-19A Ground Tests
Ditch Size 24" wide
6" deep

S/N 51-7441

Tire Pressure 2.7 psi

Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24667 | | | | | | | |
| Prior to ditch | 0 | 985 | -240 | | | | 3.0 |
| Initial Drag Strut Axial Load | .560 | 280 | 445 | | -.21 | | |
| Drag Strut Axial Load, Springback | .905 | 333 | 30 | | -.03 | | |
| Maximum Vertical Load | .210 | -380 | -160 | -.23 | | | |
| Vertical Load Rebound | .485 | 640 | 290 | +.40 | | | |
| Maximum Normal Acc. (Positive) | .455 | 620 | | +.58 | | | |
| Maximum Normal Acc. (Negative) | .740 | 230 | | -.29 | | | |
| Maximum Longitudinal Acc. (Positive) | .255 | -280 | -150 | | +.07 | | |
| Maximum Longitudinal Acc. (Negative) | .560 | 280 | 445 | | -.21 | | |
| Maximum Lateral Acc. (Pos., to Right) | .655 | 205 | 235 | | | +.50 | |
| Maximum Lateral Acc. (Neg., to Left) | 1.290 | -300 | 45 | | | -.22 | |
| Oscillograph Record No. 24681 | | | | | | | |
| Prior to ditch | 0 | 810 | -405 | | | | 10.9 |
| Initial Drag Strut Axial Load | .160 | 20 | 470 | | -.31 | | |
| Drag Strut Axial Load, Springback | .290 | 1040 | -375 | | +.35 | | |
| Maximum Vertical Load | .085 | -625 | 75 | -.44 | | | |
| Vertical Load Rebound | .250 | 1310 | -140 | +.22 | | | |
| Maximum Normal Acc. (Positive) | .260 | 1245 | | +.26 | | | |
| Maximum Normal Acc. (Negative) | .510 | -400 | | -.74 | | | |
| Maximum Longitudinal Acc. (Positive) | .290 | 1040 | -375 | | +.35 | | |
| Maximum Longitudinal Acc. (Negative) | .145 | -135 | 360 | | -.35 | | |
| Maximum Lateral Acc. (Pos., to Right) | .390 | 60 | 150 | | | +.64 | |
| Maximum Lateral Acc. (Neg., to Left) | .225 | 1150 | -45 | | | -.47 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.

All G values are incremental.

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| MODEL | | PREPARED BY | | CHECKED BY | | APPROVED BY | |
| M-245B | | | | | | | |
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| TABLE IV - continued | | | | | | | |
|--|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| L-19A HIGH FLOTATION TIRE DITCH LOADS | | | | | | | |
| L-19A Ground Tests
Ditch Size 24" wide
6" deep | | | | Data Request No. L-19-5 | | | |
| S/N 51-7441 | | | | Tire Pressure 2.7 psi | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. 24682 | | | | | | | |
| Prior to ditch | 0 | 985 | -300 | | | | 17.1 |
| Initial Drag Strut Axial Load | .168 | 75 | 680 | | -.34 | | |
| Drag Strut Axial Load, Springback | .305 | 600 | -555 | | +.01 | | |
| Maximum Vertical Load | .107 | -1055 | -20 | -1.17 | | | |
| Vertical Load Rebound | .228 | 740 | -140 | +.65 | | | |
| Maximum Normal Acc. (Positive) | .195 | 510 | | +.71 | | | |
| Maximum Normal Acc. (Negative) | .113 | -1040 | | -1.22 | | | |
| Maximum Longitudinal Acc. (Positive) | .220 | 625 | -510 | | +.28 | | |
| Maximum Longitudinal Acc. (Negative) | .145 | -305 | 300 | | -.46 | | |
| Maximum Lateral Acc. (Pos., to Right) | .130 | -810 | 320 | | | +.57 | |
| Maximum Lateral Acc. (Neg., to Left) | .312 | 455 | -170 | | | -.24 | |
| Oscillograph Record No. 24701 | | | | | | | |
| Prior to ditch | 0 | 850 | -270 | | | | 25.2 |
| Initial Drag Strut Axial Load | .110 | 680 | 910 | | -.41 | | |
| Drag Strut Axial Load, Springback | .145 | 750 | -710 | | +.47 | | |
| Maximum Vertical Load | .070 | -860 | -335 | -.59 | | | |
| Vertical Load Rebound | .138 | 1015 | -210 | +.63 | | | |
| Maximum Normal Acc. (Positive) | .158 | 770 | | +1.00 | | | |
| Maximum Normal Acc. (Negative) | .070 | -860 | | -.59 | | | |
| Maximum Longitudinal Acc. (Positive) | .158 | 770 | -355 | | +.53 | | |
| Maximum Longitudinal Acc. (Negative) | .110 | 680 | 910 | | -.41 | | |
| Maximum Lateral Acc. (Pos., to Right) | .145 | 565 | -270 | | | +.65 | |
| Maximum Lateral Acc. (Neg., to Left) | .132 | 920 | -85 | | | -.91 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

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| | | | | | | REVISED | |
| <p align="center"> TABLE IV - continued
 L-19A HIGH FLUCTUATION TIRE DITCH LOADS
 S/N 51-7441
 Tire Pressure 2.7 psi
 Data Request No. L-19-5 </p> | | | | | | | |
| <p align="center"> L-19A Ground Tests
 Ditch Size 24" wide
 6" deep </p> | | | | | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| Oscillograph Record No. 24753 | | | | | | | |
| Prior to ditch | 0 | 875 | -260 | | | | 27.1 |
| Initial Drag Strut Axial Load | .090 | 335 | 940 | | +24 | | |
| Drag Strut Axial Load, Springback | .120 | 600 | -700 | | +31 | | |
| Maximum Vertical Load | .060 | -950 | -75 | -27 | | | |
| Vertical Load Rebound | .190 | 785 | 240 | +34 | | | |
| Maximum Normal Acc. (Positive) | .097 | 725 | | +1.43 | | | |
| Maximum Normal Acc. (Negative) | .100 | 665 | | -2.31 | | | |
| Maximum Longitudinal Acc. (Positive) | .093 | 690 | 835 | | +1.00 | | |
| Maximum Longitudinal Acc. (Negative) | .108 | 750 | -20 | | -1.26 | | |
| Maximum Lateral Acc. (Pos. to Right) | .232 | 280 | -325 | | | +64 | |
| Maximum Lateral Acc. (Neg. to Left) | .202 | 610 | -135 | | | -1.02 | |
| Oscillograph Record No. 24702 | | | | | | | |
| Prior to ditch | 0 | 810 | -230 | | | | 29.9 |
| Initial Drag Strut Axial Load | .075 | 585 | 980 | | -50 | | |
| Drag Strut Axial Load, Springback | .103 | 625 | -595 | | +05 | | |
| Maximum Vertical Load | .042 | -760 | -210 | -80 | | | |
| Vertical Load Rebound | .090 | 880 | 165 | -15 | | | |
| Maximum Normal Acc. (Positive) | .125 | 665 | | +1.07 | | | |
| Maximum Normal Acc. (Negative) | .048 | -740 | | -84 | | | |
| Maximum Longitudinal Acc. (Positive) | .130 | 525 | -450 | | +45 | | |
| Maximum Longitudinal Acc. (Negative) | .080 | 770 | 865 | | -55 | | |
| Maximum Lateral Acc. (Pos. to Right) | .165 | 665 | -345 | | | +79 | |
| Maximum Lateral Acc. (Neg. to Left) | .108 | 665 | -270 | | | -1.19 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | |
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M-245B | PREPARED BY | CHECKED BY |
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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS

S/N 51-7441
Data Request No. L-19-5
Tire Pressure 2.7 psi

L-19A Flight No. 19-15
Ditch Size 24" wide
6" deep

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) |
|--------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|------------------------------|
| Oscillograph Record No. 25160 | | | | | | | |
| Prior to obstacle | 0 | 1105 | -135 | | | | 26.1 |
| Initial Drag Strut Axial Load | .040 | 100 | 1085 | | -.48 | | |
| Drag Strut Axial Load, Springback | .079 | 675 | -780 | | +.44 | | |
| Maximum Vertical Load | .007 | -1370 | -170 | -.62 | | | |
| Vertical Load Rebound | .074 | 860 | -570 | -.04 | | | |
| Maximum Normal Acc. (Positive) | .047 | 655 | | +1.71 | | | |
| Maximum Normal Acc. (Negative) | .010 | -1000 | | -.71 | | | |
| Maximum Longitudinal Acc. (Positive) | .079 | 675 | -780 | | +.44 | | |
| Maximum Longitudinal Acc. (Negative) | .046 | 715 | 855 | | -.61 | | |
| Maximum Lateral Acc. (Pos. to Right) | .035 | -145 | 360 | | | +.58 | |
| Maximum Lateral Acc. (Neg. to Left) | .074 | 860 | -570 | | | -.93 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values.

All G values are also incremental.

| | | | | | |
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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS

L-19A Flight No. 19-16
Ditch Size 24" wide
7" deep
S/N 51-7441
Tire Pressure 2.8 psi
Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) |
|--------------------------------------|---------------|---------------------------|-----------------------------|-------------------------|------------------------|-----------------------|------------------------------|
| Oscillograph Record No. <u>25181</u> | | | | | | | |
| Prior to obstacle | 0 | 1035 | -120 | | | | 30.3 |
| Initial Drag Strut Axial Load | .097 | 125 | 950 | | -.04 | | |
| Drag Strut Axial Load, Springback | .118 | 515 | -605 | | -.21 | | |
| Maximum Vertical Load | .066 | -1035 | -290 | -.57 | | | |
| Vertical Load Rebound | .104 | 845 | 250 | .33 | | | |
| Maximum Normal Acc. (Positive) | .150 | 185 | | .87 | | | |
| Maximum Normal Acc. (Negative) | .061 | -910 | | -.57 | | | |
| Maximum Longitudinal Acc. (Positive) | .140 | 310 | -95 | | .16 | | |
| Maximum Longitudinal Acc. (Negative) | .120 | 435 | -560 | | -.23 | | |
| Maximum Lateral Acc. (Pos, to Right) | .241 | 250 | -95 | | | .75 | |
| Maximum Lateral Acc. (Neg, to Left) | .125 | 395 | -335 | | | -1.01 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
|---|-------------|--|--|---|---------|
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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS
S/N 51-7441

Tire Pressure 2.8 psi Data Request No. L-19-5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) |
|--------------------------------------|---------------|---------------------------|-----------------------------------|-------------------------|------------------------|-----------------------|------------------------------|
| Oscillograph Record No. <u>25180</u> | | | | | | | |
| Prior to obstacle | 0 | 930 | -215 | | | | 18.2 |
| Initial Drag Strut Axial Load | .075 | 145 | 645 | | -.35 | | |
| Drag Strut Axial Load, Springback | .220 | 475 | -505 | | .19 | | |
| Maximum Vertical Load | .142 | -890 | 150 | -1.11 | | | |
| Vertical Load Rebound | .283 | 765 | 120 | .41 | | | |
| Maximum Normal Acc. (Positive) | .315 | 580 | | .59 | | | |
| Maximum Normal Acc. (Negative) | .142 | -890 | | -1.11 | | | |
| Maximum Longitudinal Acc. (Positive) | .290 | 560 | -440 | | .52 | | |
| Maximum Longitudinal Acc. (Negative) | .295 | 580 | -150 | | -.43 | | |
| Maximum Lateral Acc. (Pos. to Right) | .162 | -455 | 345 | | | .58 | |
| Maximum Lateral Acc. (Neg. to Left) | .278 | 725 | 160 | | | .44 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values.
All G values are also incremental.

| | | | | | |
|--|--|--|--|------------------------------|----------------|
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| SUBJECT:- <u>APPENDIX I</u>
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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS

L-19A Ground Tests
Ditch Size 12" wide
8" deep

S/N 51-7441
Tire Pressure 2.7 psi

Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24712 | | | | | | | |
| Prior to ditch | 0 | 960 | -330 | | | | 10.3 |
| Initial Drag Strut Axial Load | .132 | 220 | 550 | | -.10 | | |
| Drag Strut Axial Load, Springback | .230 | 645 | -325 | | .10 | | |
| Maximum Vertical Load | .039 | -345 | -305 | -.11 | | | |
| Vertical Load Rebound | .185 | 830 | -210 | .55 | | | |
| Maximum Normal Acc. (Positive) | .195 | 830 | | .57 | | | |
| Maximum Normal Acc. (Negative) | .039 | -345 | | -.11 | | | |
| Maximum Longitudinal Acc. (Positive) | .195 | 830 | -265 | | .18 | | |
| Maximum Longitudinal Acc. (Negative) | .096 | 80 | 125 | | -.16 | | |
| Maximum Lateral Acc. (Pos., to Right) | .227 | 670 | -295 | | | .46 | |
| Maximum Lateral Acc. (Neg., to Left) | .203 | 745 | -230 | | | -.31 | |
| Oscillograph Record No. 24713 | | | | | | | |
| Prior to ditch | 0 | 1005 | -325 | | | | 17.2 |
| Initial Drag Strut Axial Load | .130 | -275 | 465 | | -.53 | | |
| Drag Strut Axial Load, Springback | .170 | 60 | -400 | | .10 | | |
| Maximum Vertical Load | .096 | -550 | -190 | -.21 | | | |
| Vertical Load Rebound | .240 | 275 | -10 | .34 | | | |
| Maximum Normal Acc. (Positive) | .190 | 115 | | .61 | | | |
| Maximum Normal Acc. (Negative) | .163 | 80 | | -.28 | | | |
| Maximum Longitudinal Acc. (Positive) | .193 | 95 | -285 | | .30 | | |
| Maximum Longitudinal Acc. (Negative) | .130 | -275 | 465 | | -.53 | | |
| Maximum Lateral Acc. (Pos., to Right) | .232 | 105 | -315 | | | .33 | |
| Maximum Lateral Acc. (Neg., to Left) | .173 | 60 | -350 | | | -.50 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
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| <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> <p style="text-align: center;">TABLE IV - continued</p> <p style="text-align: center;">L-19A HIGH FLOTATION TIRE DITCH LOADS</p> </div> <div style="width: 45%;"> <p style="text-align: center;">S/N 51-7441</p> <p style="text-align: center;">Tire Pressure 2.7 psi</p> <p style="text-align: center;">Data Request No. L-19-5</p> </div> </div>
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="text-align: center;">L-19A Ground Tests</p> <p style="text-align: center;">Ditch Size 12" wide</p> <p style="text-align: center;">8" deep</p> </div> <div style="width: 45%;"> <p style="text-align: center;">Oscillograph Record No. 24714</p> </div> </div> | | | | | |

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Prior to ditch | 0 | 925 | -230 | | | | 27.9 |
| Initial Drag Strut Axial Load | .088 | 295 | 445 | | -.24 | | |
| Drag Strut Axial Load, Springback | .120 | 630 | -420 | | .12 | | |
| Maximum Vertical Load | .055 | -400 | 180 | -.21 | | | |
| Vertical Load Rebound | .185 | 705 | 20 | .45 | | | |
| Maximum Normal Acc. (Positive) | .152 | 440 | | .59 | | | |
| Maximum Normal Acc. (Negative) | .046 | -335 | | -.32 | | | |
| Maximum Longitudinal Acc. (Positive) | .052 | -240 | -245 | | .33 | | |
| Maximum Longitudinal Acc. (Negative) | .081 | 105 | 245 | | -.31 | | |
| Maximum Lateral Acc. (Pos., to Right) | .165 | 560 | 0 | | | .65 | |
| Maximum Lateral Acc. (Neg., to Left) | .196 | 630 | -65 | | | -.50 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

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TABLE IV - continued

L-19A HIGH FLOTATION TIRE DITCH LOADS

S/N 51-7441

Data Request No. L-19-5

Tire Pressure 2.7 psi

L-19A Ground Tests
Ditch Size 18" wide
8" deep

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24715 | | | | | | | |
| Prior to ditch | 0 | 950 | -420 | | | | 5.4 |
| Initial Drag Strut Axial Load | .302 | 345 | 455 | | -.19 | | |
| Drag Strut Axial Load, Springback | .460 | 460 | -275 | | +.12 | | |
| Maximum Vertical Load | .146 | -300 | 10 | -.21 | | | |
| Vertical Load Rebound | .394 | 790 | 135 | +.59 | | | |
| Maximum Normal Acc. (Positive) | .375 | 720 | | +.64 | | | |
| Maximum Normal Acc. (Negative) | .146 | -300 | | -.21 | | | |
| Maximum Longitudinal Acc. (Positive) | .460 | 460 | -275 | | +.12 | | |
| Maximum Longitudinal Acc. (Negative) | .302 | 345 | 455 | | -.19 | | |
| Maximum Lateral Acc. (Pos., to Right) | .569 | -205 | 125 | | | +.43 | |
| Maximum Lateral Acc. (Neg., to Left) | .350 | 710 | 315 | | | +.02 | |
| Oscillograph Record No. 24716 | | | | | | | |
| Prior to ditch | 0 | 965 | -410 | | | | 9.4 |
| Initial Drag Strut Axial Load | .223 | 380 | 340 | | -.07 | | |
| Drag Strut Axial Load, Springback | .320 | 685 | -475 | | +.41 | | |
| Maximum Vertical Load | .102 | -450 | -245 | -.30 | | | |
| Vertical Load Rebound | .303 | 870 | -200 | +.47 | | | |
| Maximum Normal Acc. (Positive) | .272 | 765 | | +.89 | | | |
| Maximum Normal Acc. (Negative) | .570 | -315 | | -.64 | | | |
| Maximum Longitudinal Acc. (Positive) | .317 | 730 | -420 | | +.46 | | |
| Maximum Longitudinal Acc. (Negative) | .413 | 35 | 30 | | -.42 | | |
| Maximum Lateral Acc. (Pos., to Right) | .432 | -75 | 150 | | | +.47 | |
| Maximum Lateral Acc. (Neg., to Left) | .245 | 505 | 0 | | | -.23 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.

All G values are also incremental.

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M-245B

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APPROVED BY

SUBJECT:-- **APPENDIX I**
LANDING GEAR TEST DATA, M-245B

DATE **January 22, 1960**

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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS

S/N 51-7441

Tire Pressure 2.7 psi

Data Request No. L-19-5

L-19A Ground Tests
Ditch Size 18" wide
8" deep

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|---------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24717 | | | | | | | |
| Prior to ditch | 0 | 930 | -275 | | | | 23.8 |
| Initial Drag Strut Axial Load | .071 | -275 | 655 | | -.26 | | |
| Drag Strut Axial Load, Springback | .130 | 425 | -675 | | +.41 | | |
| Maximum Vertical Load | .055 | -540 | -275 | -.11 | | | |
| Vertical Load Rebound | .105 | 690 | -170 | +.11 | | | |
| Maximum Normal Acc. (Positive) | .089 | -140 | | +.89 | | | |
| Maximum Normal Acc. (Negative) | .058 | -510 | | -.25 | | | |
| Maximum Longitudinal Acc. (Positive) | .130 | 425 | -675 | | +.41 | | |
| Maximum Longitudinal Acc. (Negative) | .063 | -400 | 275 | | -.44 | | |
| Maximum Lateral Acc. (Pos., to Right) | .145 | 295 | -475 | | | +.55 | |
| Maximum Lateral Acc. (Neg., to Left) | .118 | 610 | -380 | | | -.78 | |
| Oscillograph Record No. 24749 | | | | | | | |
| Prior to ditch | 0 | 985 | -270 | | | | 24.4 |
| Initial Drag Strut Axial Load | .089 | -360 | 660 | | -.37 | | |
| Drag Strut Axial Load, Springback | .156 | 350 | -575 | | +.83 | | |
| Maximum Vertical Load | .067 | -640 | -545 | .00 | | | |
| Vertical Load Rebound | .123 | 645 | -345 | -.06 | | | |
| Maximum Normal Acc. (Positive) | .115 | 640 | | +1.91 | | | |
| Maximum Normal Acc. (Negative) | .105 | 585 | | -2.00 | | | |
| Maximum Longitudinal Acc. (Positive) | .105 | 585 | 430 | | +1.26 | | |
| Maximum Longitudinal Acc. (Negative) | .113 | 625 | 10 | | -1.09 | | |
| Maximum Lateral Acc. (Pos., to Right) | .161 | 255 | -420 | | | +.47 | |
| Maximum Lateral Acc. (Neg., to Left) | .133 | 570 | -395 | | | -.92 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

MODEL M-245B

PREPARED BY

CHECKED BY

APPROVED BY

APPENDIX I

SUBJECT: LANDING GEAR TEST DATA, M-245B

DATE January 22, 1960

REVISED

TABLE IV - continued

L-19A HIGH FLOTATION TIRE DITCH LOADS

L-19A Ground Tests
Ditch Size 24" wide
8" deep

S/N 51-7441

Tire Pressure 2.7 psi

Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24718* | | | | | | | |
| Prior to ditch | 0 | 970 | -455 | | | | 5.1 |
| Initial Drag Strut Axial Load | .450 | 950 | 970 | | -.27 | | |
| Drag Strut Axial Load, Springback | .620 | -60 | -105 | | -.07 | | |
| Maximum Vertical Load | .240 | -445 | -20 | -.25 | | | |
| Vertical Load Rebound | .495 | 1000 | 590 | +.85 | | | |
| Maximum Normal Acc. (Positive) | .460 | 980 | | +.93 | | | |
| Maximum Normal Acc. (Negative) | .230 | -430 | | -.32 | | | |
| Maximum Longitudinal Acc. (Positive) | .600 | 185 | 0 | | +.03 | | |
| Maximum Longitudinal Acc. (Negative) | .460 | 980 | 825 | | -.29 | | |
| Maximum Lateral Acc. (Pos., to Right) | .630 | -120 | 160 | | | +.34 | |
| Maximum Lateral Acc. (Neg., to Left) | .287 | -95 | 275 | | | -.01 | |
| Oscillograph Record No. 24719 | | | | | | | |
| Prior to ditch | 0 | 980 | -410 | | | | 4.3 |
| Initial Drag Strut Axial Load | .488 | 860 | 1035 | | -.41 | | |
| Drag Strut Axial Load, Springback | .680 | -195 | -40 | | -.14 | | |
| Maximum Vertical Load | .215 | -565 | -40 | -.34 | | | |
| Vertical Load Rebound | .433 | 1065 | 770 | +.89 | | | |
| Maximum Normal Acc. (Positive) | .429 | 1055 | | +.93 | | | |
| Maximum Normal Acc. (Negative) | .200 | -525 | | -.36 | | | |
| Maximum Longitudinal Acc. (Positive) | .615 | 285 | 160 | | -.04 | | |
| Maximum Longitudinal Acc. (Negative) | .500 | 750 | 905 | | -.42 | | |
| Maximum Lateral Acc. (Pos., to Right) | .610 | 305 | 180 | | | +.45 | |
| Maximum Lateral Acc. (Neg., to Left) | .339 | 410 | 150 | | | -.10 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

* Did not hit ditch squarely.

| | | | | | |
|--------------------|--|--------------------------------------|--|-----------------------|---------|
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| MODEL M-245B | | PREPARED BY | | APPROVED BY | |
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| | | LANDING GEAR TEST DATA, M-245B | | REVISED | |

TABLE IV - continued

L-19A HIGH FLOTATION TIRE DITCH LOADS

S/N 51-7441

Tire Pressure 2.7 psi

Data Request No. L-19-5

| Item (Event) | Time (Sec.) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) |
|---------------------------------------|-------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|
| Oscillograph Record No. 24750 | | | | | | | |
| Prior to ditch | 0 | 1025 | -345 | | | | 8.0 |
| Initial Drag Strut Axial Load | .232 | -75 | 825 | | -35 | | |
| Drag Strut Axial Load, Springback | .378 | 1465 | -775 | | +67 | | |
| Maximum Vertical Load | .121 | -750 | 75 | -44 | | | |
| Vertical Load Rebound | .363 | 1775 | -325 | +1.80 | | | |
| Maximum Normal Acc. (Positive) | .363 | 1775 | | +1.80 | | | |
| Maximum Normal Acc. (Negative) | .512 | -450 | | -.92 | | | |
| Maximum Longitudinal Acc. (Positive) | .401 | 1030 | -500 | | +86 | | |
| Maximum Longitudinal Acc. (Negative) | .389 | 1295 | -85 | | -46 | | |
| Maximum Lateral Acc. (Pos., to Right) | .482 | -265 | 230 | | | +74 | |
| Maximum Lateral Acc. (Neg., to Left) | .354 | 1755 | -125 | | | -.39 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
|---|--|---|--|----------------------|--|
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| MODEL M-245B | | PREPARED BY | | CHECKED BY | |
| SUBJECT: APPENDIX I
LANDING GEAR TEST DATA, M-245B | | DATE January 22, 1960 | | REVISED | |

| TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS
S/N 51-7441
Tire Pressure 2.7 psi
Data Request No. L-19-5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---------------------------|-----------------------------------|---------------------------|-----------------------------------|-------------------------|------------------------------|-----------------------|------------------------------|--------------------------------------|--|--|--|--|--|--|--|-------------------|---|-----|------|--|--|--|-----|-------------------------------|------|------|-----|--|------|--|--|-----------------------------------|------|------|------|--|-----|--|--|-----------------------|------|------|-----|------|--|--|--|-----------------------|------|------|------|------|--|--|--|--------------------------------|------|------|--|------|--|--|--|--------------------------------|------|------|--|------|--|--|--|--------------------------------------|------|------|------|--|-----|--|--|--------------------------------------|------|-----|-----|--|------|--|--|--------------------------------------|------|-----|----|--|--|------|--|-------------------------------------|------|------|-----|--|--|------|--|
| L-19A Flight No. 19-15
Ditch Size 24" wide
8" deep | <table border="1"> <thead> <tr> <th>Item
(Event)</th> <th>Time
(Sec)</th> <th>Vertical
Load
(Lbs)</th> <th>Drag Strut
Axial Load
(Lbs)</th> <th>Normal
Acc.
(g's)</th> <th>Long.
Acc.
(g's)</th> <th>Lat.
Acc.
(g's)</th> <th>Forward
Velocity
(MPH)</th> </tr> </thead> <tbody> <tr> <td colspan="8">Oscillograph Record No. 25162</td> </tr> <tr> <td>Prior to obstacle</td> <td>0</td> <td>960</td> <td>-230</td> <td></td> <td></td> <td></td> <td>7.1</td> </tr> <tr> <td>Initial Drag Strut Axial Load</td> <td>.155</td> <td>-305</td> <td>560</td> <td></td> <td>-.28</td> <td></td> <td></td> </tr> <tr> <td>Drag Strut Axial Load, Springback</td> <td>.330</td> <td>1225</td> <td>-580</td> <td></td> <td>.38</td> <td></td> <td></td> </tr> <tr> <td>Maximum Vertical Load</td> <td>.088</td> <td>-655</td> <td>-10</td> <td>-.41</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Vertical Load Rebound</td> <td>.310</td> <td>1510</td> <td>-135</td> <td>1.43</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum Normal Acc. (Positive)</td> <td>.310</td> <td>1510</td> <td></td> <td>1.43</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum Normal Acc. (Negative)</td> <td>.553</td> <td>-655</td> <td></td> <td>-.83</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Maximum Longitudinal Acc. (Positive)</td> <td>.292</td> <td>1490</td> <td>-210</td> <td></td> <td>.55</td> <td></td> <td></td> </tr> <tr> <td>Maximum Longitudinal Acc. (Negative)</td> <td>.394</td> <td>165</td> <td>190</td> <td></td> <td>-.51</td> <td></td> <td></td> </tr> <tr> <td>Maximum Lateral Acc. (Pos. to Right)</td> <td>.415</td> <td>-60</td> <td>85</td> <td></td> <td></td> <td>1.00</td> <td></td> </tr> <tr> <td>Maximum Lateral Acc. (Neg. to Left)</td> <td>.382</td> <td>1510</td> <td>230</td> <td></td> <td></td> <td>-.08</td> <td></td> </tr> </tbody> </table> | Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) | Oscillograph Record No. 25162 | | | | | | | | Prior to obstacle | 0 | 960 | -230 | | | | 7.1 | Initial Drag Strut Axial Load | .155 | -305 | 560 | | -.28 | | | Drag Strut Axial Load, Springback | .330 | 1225 | -580 | | .38 | | | Maximum Vertical Load | .088 | -655 | -10 | -.41 | | | | Vertical Load Rebound | .310 | 1510 | -135 | 1.43 | | | | Maximum Normal Acc. (Positive) | .310 | 1510 | | 1.43 | | | | Maximum Normal Acc. (Negative) | .553 | -655 | | -.83 | | | | Maximum Longitudinal Acc. (Positive) | .292 | 1490 | -210 | | .55 | | | Maximum Longitudinal Acc. (Negative) | .394 | 165 | 190 | | -.51 | | | Maximum Lateral Acc. (Pos. to Right) | .415 | -60 | 85 | | | 1.00 | | Maximum Lateral Acc. (Neg. to Left) | .382 | 1510 | 230 | | | -.08 | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | Drag Strut
Axial Load
(Lbs) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Forward
Velocity
(MPH) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Oscillograph Record No. 25162 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prior to obstacle | 0 | 960 | -230 | | | | 7.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Initial Drag Strut Axial Load | .155 | -305 | 560 | | -.28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Drag Strut Axial Load, Springback | .330 | 1225 | -580 | | .38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Vertical Load | .088 | -655 | -10 | -.41 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vertical Load Rebound | .310 | 1510 | -135 | 1.43 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Normal Acc. (Positive) | .310 | 1510 | | 1.43 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Normal Acc. (Negative) | .553 | -655 | | -.83 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Longitudinal Acc. (Positive) | .292 | 1490 | -210 | | .55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Longitudinal Acc. (Negative) | .394 | 165 | 190 | | -.51 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Lateral Acc. (Pos. to Right) | .415 | -60 | 85 | | | 1.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Lateral Acc. (Neg. to Left) | .382 | 1510 | 230 | | | -.08 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain loads, add calibrated loads prior to contact with obstacle to incremental values. All G values are also incremental.

| | | | | | |
|---|-------------|---|-------------|---|----------------|
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TABLE IV - continued
L-19A HIGH FLOTATION TIRE DITCH LOADS

L-19A Ground Tests
Ditch Size 24" wide
4" deep

S/N 51-7441
Tire Pressure 3.6 ± 2 psi

Data Request No. L-19-5

| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs.) | Drag Strut
Axial Load
(lbs.) | Normal
Acc.
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---------------------------------------|----------------|----------------------------|------------------------------------|-------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 24728 | | | | | | | |
| Prior to ditch | 0 | 1070 | -305 | | | | 3.3 |
| Initial Drag Strut Axial Load | .375 | 820 | 305 | | -.07 | | |
| Drag Strut Axial Load, Springback | .452 | 465 | -495 | | +.23 | | |
| Maximum Vertical Load | .185 | -620 | -105 | -.23 | | | |
| Vertical Load Rebound | .410 | 945 | 180 | +.83 | | | |
| Maximum Normal Acc. (Positive) | .390 | 845 | | +.91 | | | |
| Maximum Normal Acc. (Negative) | .170 | -570 | | -.30 | | | |
| Maximum Longitudinal Acc. (Positive) | .452 | 465 | -495 | | +.23 | | |
| Maximum Longitudinal Acc. (Negative) | .295 | 265 | 210 | | -.11 | | |
| Maximum Lateral Acc. (Pos., to Right) | .540 | -195 | -190 | | | +.54 | |
| Maximum Lateral Acc. (Neg., to Left) | .295 | 265 | 210 | | | -.03 | |
| Oscillograph Record No. 24729 | | | | | | | |
| Prior to ditch | 0 | 960 | -390 | | | | 9.8 |
| Initial Drag Strut Axial Load | .182 | 235 | 370 | | -.10 | | |
| Drag Strut Axial Load, Springback | .282 | 900 | -485 | | +.19 | | |
| Maximum Vertical Load | .089 | -680 | 65 | -.21 | | | |
| Vertical Load Rebound | .250 | 1125 | -265 | +.93 | | | |
| Maximum Normal Acc. (Positive) | .250 | 1125 | | +.93 | | | |
| Maximum Normal Acc. (Negative) | .080 | -645 | | -.23 | | | |
| Maximum Longitudinal Acc. (Positive) | .265 | 1005 | -410 | | +.29 | | |
| Maximum Longitudinal Acc. (Negative) | .150 | -45 | 265 | | -.15 | | |
| Maximum Lateral Acc. (Pos., to Right) | .418 | -225 | 30 | | | +.39 | |
| Maximum Lateral Acc. (Neg., to Left) | .220 | 805 | 135 | | | -.11 | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
|--------------------|--|--|--|-----------------------|---------|
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| MODEL M-245B | | OF FAIRCHILD ENGINE & AIRPLANE CORPORATION | | APPROVED BY | |
| SUBJECT:- | | APPENDIX I
LANDING GEAR TEST DATA, M-245B | | DATE January 22, 1960 | |
| | | | | REVISED | |

| <p style="text-align: center;">TABLE IV - continued</p> <p style="text-align: center;">L-19A HIGH FLOTATION TIRE DITCH LOADS</p> <p style="text-align: center;">S/N 51-7441</p> <p style="text-align: center;">Tire Pressure 3.6 \pm 2 psi</p> <p style="text-align: center;">Data Request No. L-19-5</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|-------------------|----------------------|------------------------------|-------------------|------------------|-----------------|-------------|---|-----|------|--|--|--|------|------|-----|-----|--|------|--|--|------|-----|------|--|------|--|--|------|------|-----|-------|--|--|--|------|-----|----|------|--|--|--|------|------|--|------|--|--|--|------|------|--|-------|--|--|--|------|-----|------|--|------|--|--|------|-----|-----|--|------|--|--|------|------|-----|--|--|------|--|------|-----|-----|--|--|------|--|
| <p>L-19A Ground Tests</p> <p>Ditch Size 24" wide</p> <p>4" deep</p> | <p>Oscillograph Record No. 24730</p> <p>Prior to ditch</p> <p>Initial Drag Strut Axial Load</p> <p>Drag Strut Axial Load, Springback</p> <p>Maximum Vertical Load</p> <p>Vertical Load Rebound</p> <p>Maximum Normal Acc. (Positive)</p> <p>Maximum Normal Acc. (Negative)</p> <p>Maximum Longitudinal Acc. (Positive)</p> <p>Maximum Longitudinal Acc. (Negative)</p> <p>Maximum Lateral Acc. (Pos., to Right)</p> <p>Maximum Lateral Acc. (Neg., to Left)</p> | <table border="1"> <thead> <tr> <th>Time (Sec)</th> <th>Vertical Load (lbs.)</th> <th>Drag Strut Axial Load (lbs.)</th> <th>Normal Acc. (g's)</th> <th>Long. Acc. (g's)</th> <th>Lat. Acc. (g's)</th> <th>Speed (MPH)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>930</td> <td>-380</td> <td></td> <td></td> <td></td> <td>17.0</td> </tr> <tr> <td>.160</td> <td>-40</td> <td>675</td> <td></td> <td>-.56</td> <td></td> <td></td> </tr> <tr> <td>.200</td> <td>410</td> <td>-515</td> <td></td> <td>+.34</td> <td></td> <td></td> </tr> <tr> <td>.125</td> <td>-980</td> <td>220</td> <td>-1.55</td> <td></td> <td></td> <td></td> </tr> <tr> <td>.267</td> <td>605</td> <td>40</td> <td>+.38</td> <td></td> <td></td> <td></td> </tr> <tr> <td>.163</td> <td>-145</td> <td></td> <td>+.47</td> <td></td> <td></td> <td></td> </tr> <tr> <td>.123</td> <td>-960</td> <td></td> <td>-1.78</td> <td></td> <td></td> <td></td> </tr> <tr> <td>.200</td> <td>410</td> <td>-515</td> <td></td> <td>+.34</td> <td></td> <td></td> </tr> <tr> <td>.160</td> <td>-40</td> <td>675</td> <td></td> <td>-.56</td> <td></td> <td></td> </tr> <tr> <td>.143</td> <td>-720</td> <td>285</td> <td></td> <td></td> <td>+.53</td> <td></td> </tr> <tr> <td>.261</td> <td>585</td> <td>170</td> <td></td> <td></td> <td>-.54</td> <td></td> </tr> </tbody> </table> | Time (Sec) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) | 0 | 930 | -380 | | | | 17.0 | .160 | -40 | 675 | | -.56 | | | .200 | 410 | -515 | | +.34 | | | .125 | -980 | 220 | -1.55 | | | | .267 | 605 | 40 | +.38 | | | | .163 | -145 | | +.47 | | | | .123 | -960 | | -1.78 | | | | .200 | 410 | -515 | | +.34 | | | .160 | -40 | 675 | | -.56 | | | .143 | -720 | 285 | | | +.53 | | .261 | 585 | 170 | | | -.54 | |
| Time (Sec) | Vertical Load (lbs.) | Drag Strut Axial Load (lbs.) | Normal Acc. (g's) | Long. Acc. (g's) | Lat. Acc. (g's) | Speed (MPH) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 930 | -380 | | | | 17.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .160 | -40 | 675 | | -.56 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .200 | 410 | -515 | | +.34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .125 | -980 | 220 | -1.55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .267 | 605 | 40 | +.38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .163 | -145 | | +.47 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .123 | -960 | | -1.78 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .200 | 410 | -515 | | +.34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .160 | -40 | 675 | | -.56 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .143 | -720 | 285 | | | +.53 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| .261 | 585 | 170 | | | -.54 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: All Vertical and Drag Strut Axial Loads tabulated above are incremental. To obtain total loads, add calibrated loads prior to contact with ditch to incremental values.
All G values are also incremental.

| | | | | | |
|---------------------------|--|--|------------|------------------------------|----------------|
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| TABLE V | | | | | | | | | | |
|--|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|------------------------|-----------------------|----------------|--|
| <u>L-19A HIGH FLOTATION TIRE LANDING LOADS</u> | | | | | | | | | | |
| L-19A Flight No. L-19-12 | | S/N 51-7441 | | Data Request No. L-19-6 | | | | | | |
| Tire Pressure - L. 8.6 psi | | Sinking Speed 1.2 fps | | | | | | | | |
| R. 8.5 psi | | | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) | |
| | | Right | Left | Right | Left | | | | | |
| Oscillograph Record No. 24939 | | | | | | | | | | |
| First Gear Contact (Right Main) | 0 | | | | | | | | 42.3* | |
| Initial Left Drag Strut Axial Load | .210 | 470 | 655 | - 330 | 700 | | -.59 | | | |
| Left Drag Strut Axial Load, Springback | .245 | 125 | 545 | 110 | - 480 | | .04 | | | |
| Left Drag Strut Axial Load, 2nd Cycle | .280 | 50 | 485 | 110 | 200 | | -.22 | | | |
| Maximum Left Gear Vertical Load | .183 | 720 | 745 | 280 | 260 | +1.41 | | | | |
| Left Gear Vertical Load Rebound | .428 | 80 | 55 | 40 | - 80 | .89 | | | | |
| Initial Right Drag Strut Axial Load | .128 | 1000 | 445 | 880 | 320 | | -.57 | | | |
| Right Drag Strut Axial Load, Springback | .150 | 805 | 440 | -1140 | 410 | | .18 | | | |
| Right Drag Strut Axial Load, 2nd Cycle | .183 | 720 | 745 | 280 | 260 | | -.22 | | | |
| Maximum Right Gear Vertical Load | .130 | 1000 | 470 | 750 | 350 | +1.39 | | | | |
| Right Gear Vertical Load Rebound | .298 | - 35 | 420 | 110 | - 150 | 1.02 | | | | |
| Maximum C.G. Load Factor (Positive) | .182 | 720 | 745 | | | 1.41 | | | | |
| Maximum C.G. Load Factor (Negative) | .422 | 70 | 55 | | | .85 | | | | |
| Maximum Longitudinal Accel. (Positive) | .151 | 770 | 445 | -1110 | 500 | | .42 | | | |
| Maximum Longitudinal Accel. (Negative) | .210 | 470 | 655 | - 330 | 700 | | -.59 | | | |
| Maximum Lateral Accel. (Pos., to Right) | .154 | 770 | 510 | - 840 | 600 | | | .40 | | |
| Maximum Lateral Accel. (Neg., to Left) | .110 | 895 | 470 | 700 | 30 | | | -.14 | | |

* Wheel speed measured at instant of tail wheel touchdown.

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| <p style="text-align: center;">TABLE V - continued</p> <p style="text-align: center;"><u>L-19A HIGH FLOTATION TIRE LANDING LOADS</u></p> <p style="text-align: center;">S/N 51-7441 Data Request No. L-19-6</p> <p style="text-align: center;">Sinking Speed 1.4 fps</p> <p style="text-align: center;">L-19A Flight No. L-19-12 Tire Pressure - L. 8.6 psi R. 8.6 psi</p> | | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. 24937 | | | | | | | | | |
| First Gear Contact (Both) | 0 | | | | | | | | -- |
| Initial Left Drag Strut Axial Load | .130 | 1130 | 1030 | 770 | 860 | | .57 | | |
| Left Drag Strut Axial Load, Springback | .170 | 865 | 995 | - 170 | - 920 | | 0 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .205 | 730 | 710 | - 220 | - 280 | | .30 | | |
| Maximum Left Gear Vertical Load | .150 | 895 | 1070 | - 520 | 800 | 1.66 | | | |
| Left Gear Vertical Load Rebound | .295 | 145 | 10 | 100 | 10 | .89 | | | |
| Initial Right Drag Strut Axial Load | .112 | 1015 | 895 | 820 | 510 | | -.75 | | |
| Right Drag Strut Axial Load, Springback | .156 | 880 | 1015 | - 800 | 480 | | .06 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .188 | 935 | 940 | 570 | - 220 | | -.38 | | |
| Maximum Right Gear Vertical Load | .135 | 1140 | 1030 | 780 | 860 | 1.66 | | | |
| Right Gear Vertical Load Rebound | .341 | - 40 | 115 | 80 | 20 | .79 | | | |
| Maximum C.G. Load Factor (Positive) | .140 | 1045 | 1050 | | | 1.66 | | | |
| Maximum C.G. Load Factor (Negative) | .345 | - 10 | 120 | | | .79 | | | |
| Maximum Longitudinal Accel. (Positive) | .160 | 900 | 995 | - 790 | 40 | | .59 | | |
| Maximum Longitudinal Accel. (Negative) | .128 | 1100 | 1025 | 700 | 840 | | -.77 | | |
| Maximum Lateral Accel. (Pos., to Right) | .317 | 120 | 85 | - 30 | 10 | | | .20 | |
| Maximum Lateral Accel. (Neg., to Left) | .173 | 855 | 985 | - 50 | - 890 | | | -.32 | |

| | | | | | |
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TABLE V - continued
L-19A HIGH FLUTATION TIRE LANDING LOADS
S/N 51-7441
Sinking Speed 1.5 fps
Data Request No. L-19-6
L-19A Flight No. L-19-15
Tire Pressure - L. 8.8 psi
R. 8.5 psi

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|--|---------------|---------------------------|------|-----------------------------------|------|------------------------------|------------------------|-----------------------|----------------|
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. <u>25149</u> | | | | | | | | | |
| First Gear Contact (Right Main) | 0 | | | | | | | | 46.1 |
| Initial Left Drag Strut Axial Load | .189 | 410 | 590 | -395 | 600 | | -.26 | | |
| Left Drag Strut Axial Load, Springback | .245 | 245 | 470 | -60 | -464 | | -.18 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .273 | 130 | 450 | -20 | 265 | | -.40 | | |
| Maximum Left Gear Vertical Load | .205 | 390 | 615 | 80 | 455 | +1.43 | | | |
| Left Gear Vertical Load Rebound | .538 | 95 | 0 | -20 | -10 | + .66 | | | |
| Initial Right Drag Strut Axial Load | .129 | 655 | 410 | 565 | 285 | | -.48 | | |
| Right Drag Strut Axial Load, Spring back | .182 | 430 | 550 | -555 | 390 | | -.26 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .214 | 390 | 590 | 150 | 325 | | -.36 | | |
| Maximum Right Gear Vertical Load | .130 | 655 | 410 | 435 | 295 | +1.47 | | | |
| Right Gear Vertical Load Rebound | .333 | -35 | 205 | -80 | 65 | + .96 | | | |
| Maximum C.G. Load Factor (Positive) | .100 | 600 | 390 | | | +1.58 | | | |
| Maximum C.G. Load Factor (Negative) | .634 | 35 | 80 | | | + .53 | | | |
| Maximum Longitudinal Accel. (Positive) | .238 | 260 | 450 | -180 | -400 | | -.12 | | |
| Maximum Longitudinal Accel. (Negative) | .137 | 615 | 390 | 415 | 410 | | -.55 | | |
| Maximum Lateral Accel. (Pos., to Right) | .284 | 95 | 410 | -80 | 40 | | | + .15 | |
| Maximum Lateral Accel. (Neg., to Left) | .310 | 55 | 265 | 90 | -135 | | | -.20 | |

| | | | | | |
|---|--|--------------------------------------|------------|------------------------------|---------|
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TABLE V - continued
L-19A HIGH FLOTATION TIRE LANDING LOADS
 S/N 51-7441
 Sinking Speed 1.9 fps
 Data Request No. L-19-6
 L-19A Flight No. L-19-11
 Tire Pressure - L. 4.1 psi
 R. 4.3 psi

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long. Acc.
(g's) | Lat. Acc.
(g's) | Speed
(MPH) |
|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|---------------------|--------------------|----------------|
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. 24929 | 0 | | | | | | | | 52.9* |
| First Gear Contact (Right Main) | | | | | | | | | |
| Initial Left Drag Strut Axial Load | .170 | 985 | 445 | - 80 | 1060 | | - .10 | | |
| Left Drag Strut Axial Load, Springback | .198 | 895 | 1290 | - 150 | - 960 | | + .23 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .230 | 730 | 1170 | - 330 | 360 | | - .06 | | |
| Maximum Left Gear Vertical Load | .175 | 1050 | 1400 | - 430 | 850 | 1.81 | | | |
| Left Gear Vertical Load Rebound | .405 | 120 | -100 | 0 | - 50 | .91 | | | |
| Initial Right Drag Strut Axial Load | .145 | 995 | 1120 | 590 | 470 | | - .45 | | |
| Right Drag Strut Axial Load, Springback | .182 | 975 | 445 | - 960 | 190 | | + .59 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .213 | 895 | 1330 | 210 | - 160 | | 0 | | |
| Maximum Right Gear Vertical Load | .175 | 1050 | 1400 | - 430 | 850 | 1.81 | | | |
| Right Gear Vertical Load Rebound | .353 | -110 | 305 | - 170 | - 110 | .89 | | | |
| Maximum C.G. Load Factor (Positive) | .180 | 985 | 1360 | | | 1.81 | | | |
| Maximum C.G. Load Factor (Negative) | .395 | 180 | 70 | | | .89 | | | |
| Maximum Longitudinal Accel. (Positive) | .183 | 665 | 680 | 500 | 530 | | + .61 | | |
| Maximum Longitudinal Accel. (Negative) | .095 | 975 | 955 | - 520 | 110 | | - .59 | | |
| Maximum Lateral Accel. (Pos. to Right) | .295 | 130 | 905 | - 70 | - 80 | | | .68 | |
| Maximum Lateral Accel. (Neg. to Left) | .271 | 370 | 935 | 30 | - 70 | | | -.40 | |

* Ground speed measured at instant of tail wheel touchdown.

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TABLE V - continued

L-19A HIGH FLOTATION TIRE LANDING LOADS

L-19A Flight No. L-19-14

Tire Pressure - L. 9.0 psi

R. 8.7 psi

S/N 51-7441

Sinking Speed 2.4 fps

Data Request No. L-19-6

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|------------------------|-----------------------|----------------|
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. 24967 | | | | | | | | | |
| First Gear Contact (Both) | 0 | | | | | | | | 50.3* |
| Initial Left Drag Strut Axial Load | .109 | 1070 | 1620 | 650 | 1110 | | -.52 | | |
| Left Drag Strut Axial Load, Springback | .129 | 1210 | 1610 | 1330 | 1880 | | .49 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .161 | 1000 | 1220 | 780 | 620 | | -.27 | | |
| Maximum Left Gear Vertical Load | .110 | 1080 | 1645 | 670 | 1050 | 1.95 | | | |
| Left Gear Vertical Load Rebound | .320 | 20 | 10 | - 80 | -160 | .72 | | | |
| Initial Right Drag Strut Axial Load | .130 | 1235 | 1620 | 1350 | 1840 | | .29 | | |
| Right Drag Strut Axial Load, Springback | .152 | 1055 | 1150 | 1300 | 220 | | .34 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .185 | 935 | 1045 | 550 | 800 | | .11 | | |
| Maximum Right Gear Vertical Load | .134 | 1275 | 1620 | 1190 | 1590 | 1.95 | | | |
| Right Gear Vertical Load Rebound | .404 | - 20 | 95 | - 20 | 110 | 1.02 | | | |
| Maximum C.G. Load Factor (Positive) | .130 | 1235 | 1620 | | | 1.97 | | | |
| Maximum C.G. Load Factor (Negative) | .382 | - 10 | 35 | | | .35 | | | |
| Maximum Longitudinal Accel. (Positive) | .128 | 1170 | 1540 | 1280 | -1720 | | .53 | | |
| Maximum Longitudinal Accel. (Negative) | .110 | 1080 | 1645 | 670 | 1050 | | -.56 | | |
| Maximum Lateral Accel. (Pos, to Right) | .172 | 845 | 1190 | - 50 | 110 | | | .46 | |
| Maximum Lateral Accel. (Neg., to Left) | .192 | 865 | 950 | - 80 | -610 | | | -.62 | |

* Ground speed measured at instant of tail wheel touchdown.

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TABLE V - continued
L-19A HIGH FLUTATION TIRE LANDING LOADSL-19A Flight No. L-19-13
Tire Pressure - L. 8.6 psi
R. 8.6 psi

S/N 51-7441

Sinking Speed 2.5 fts

Data Request No. L-19-6

| Item
(Event) | Time | Vertical Load (lbs) | | Drag Strut Axial Load (lbs) | | C.G. Load Factor (g's) | Long. Acc. (g's) | Lat. Speed Acc. (g's)(MPH) |
|---|------|---------------------|------|-----------------------------|-------|------------------------|------------------|----------------------------|
| | | Right | Left | Right | Left | | | |
| Oscillograph Record No. 24246 | | | | | | | | |
| First Gear Contact (Right Main) | 0 | | | | | | | 35.1* |
| Initial Left Drag Strut Axial Load | .210 | 920 | 1435 | - 590 | 1460 | | -.23 | |
| Left Drag Strut Axial Load, Springback | .246 | 410 | 1210 | 90 | -1320 | | .24 | |
| Left Drag Strut Axial Load, 2nd Cycle | .277 | 355 | 750 | - 160 | 480 | | -.12 | |
| Maximum Left Gear Vertical Load | .228 | 855 | 1595 | - 200 | 700 | 1.87 | | |
| Left Gear Vertical Load Rebound | .600 | 110 | 65 | + 40 | - 30 | 1.33 | | |
| Initial Right Drag Strut Axial Load | .120 | 1250 | 140 | 940 | - 10 | | -.35 | |
| Right Drag Strut Axial Load, Springback | .154 | 1065 | 790 | -1220 | 1000 | | .05 | |
| Right Drag Strut Axial Load, 2nd Cycle | .188 | 1080 | 1315 | 80 | 520 | | -.12 | |
| Maximum Right Gear Vertical Load | .130 | 1295 | 155 | 740 | 110 | 1.57 | | |
| Right Gear Vertical Load Rebound | .305 | -165 | 890 | - 10 | - 540 | 1.24 | | |
| Maximum C.G. Load Factor (Positive) | .220 | 935 | 1505 | | | 1.96 | | |
| Maximum C.G. Load Factor (Negative) | .600 | 110 | 65 | | | .80 | | |
| Maximum Longitudinal Accel. (Positive) | .244 | 445 | 1230 | 70 | -1270 | | .34 | |
| Maximum Longitudinal Accel. (Negative) | .165 | 1070 | 1130 | - 530 | 860 | | -.42 | |
| Maximum Lateral Accel. (Pos., to Right) | .158 | 1070 | 965 | -1070 | 1070 | | | .60 |
| Maximum Lateral Accel (Neg., to Left) | .435 | 30 | 85 | 40 | - 50 | | | -.33 |

* Wheel speed measured at instant of tail wheel touchdown.

| | | | | | | |
|--|--------|--|------------|------------------------------|------|----|
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| | | | | | |
|----------------------------|--|---|--|-------------------------|--|
| TABLE V - continued | | L-19A HIGH FLOTATION TIRE LANDING LOADS | | Data Request No. L-19-6 | |
| L-19A Flight No. L-19-11 | | S/N 51-7441 | | Sinking Speed 2.6 fps | |
| Tire Pressure - L. 8.5 psi | | | | R. 8.3 psi | |

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|------------------------|-----------------------|----------------|
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. 24931 | | | | | | | | | |
| First Gear Contact (Right Main) | 0 | | | | | | | | 51.1* |
| Initial Left Drag Strut Axial Load | .228 | 960 | 1540 | -220 | 1410 | | -.27 | | |
| Left Drag Strut Axial Load, Springback | .256 | 690 | 1450 | -20 | -1850 | | -.92 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .285 | 760 | 1150 | -200 | 370 | | +.02 | | |
| Maximum Left Gear Vertical Load | .245 | 925 | 1950 | -270 | 80 | 2.24 | | | |
| Left Gear Vertical Load Rebound | .574 | 80 | 215 | -10 | -10 | .76 | | | |
| Initial Right Drag Strut Axial Load | .105 | 1490 | 0 | +1240 | -180 | | -.67 | | |
| Right Drag Strut Axial Load, Springback | .126 | 1390 | -155 | -1760 | 20 | | -.76 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .150 | 1235 | 110 | 500 | 310 | | -.65 | | |
| Maximum Right Gear Vertical Load | .112 | 1590 | 55 | 310 | -100 | 1.92 | | | |
| Right Gear Vertical Load Rebound | .423 | -25 | 445 | 20 | -190 | .94 | | | |
| Maximum C.G. Load Factor (Positive) | .125 | 1400 | -125 | | | 2.39 | | | |
| Maximum C.G. Load Factor (Negative) | .590 | 120 | 245 | | | .76 | | | |
| Maximum Longitudinal Accel. (Positive) | .165 | 1280 | 695 | 30 | 330 | | .61 | | |
| Maximum Longitudinal Accel. (Negative) | .133 | 1290 | -210 | -1020 | 130 | | -1.68 | | |
| Maximum Lateral Accel. (Pos. to Right) | .133 | 1290 | -210 | -1020 | 130 | | | .39 | |
| Maximum Lateral Accel. (Neg., to Left) | .220 | 950 | 1415 | -170 | 1330 | | | -.28 | |

* Ground speed measured at instant of tail wheel touchdown.

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 LANDING GEAR TEST DATA, M-245B

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TABLE V - continued

L-19A HIGH FLUTATION TIRE LANDING LOADS

 L-19A Flight No. L-19-15
 Tire Pressure - L. 8.9 psi
 R. 8.5 psi

S/N 51-7441

Sinking Speed 2.7 fps

Data Request No. L-19-6

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|------------------------|-----------------------|----------------|
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. 25150 | 0 | | | | | | | | 47.6 |
| First Gear Contact (Left Main) | | | | | | | | | |
| Initial Left Drag Strut Axial Load | .072 | -35 | 1450 | -130 | 1570 | | -.59 | | |
| Left Drag Strut Axial Load, Springback | .100 | 390 | 1570 | 860 | -1845 | | -.22 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .127 | 895 | 1430 | 180 | 540 | | -.42 | | |
| Maximum Left Gear Vertical Load | .089 | 110 | 1795 | 245 | 115 | 1.68 | | | |
| Left Gear Vertical Load Rebound | .476 | 130 | -20 | 10 | -30 | .85 | | | |
| Initial Right Drag Strut Axial Load | .151 | 1085 | 1350 | 1640 | -635 | | -.38 | | |
| Right Drag Strut Axial Load, Springback | .190 | 1030 | 980 | -1285 | 65 | | .12 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .210 | 935 | 1000 | 255 | 190 | | -.12 | | |
| Maximum Right Gear Vertical Load | .171 | 345 | 1245 | 655 | -275 | 1.60 | | | |
| Right Gear Vertical Load Rebound | .410 | -55 | 285 | -40 | -65 | .89 | | | |
| Maximum C.G. Load Factor (Positive) | .138 | 915 | 1390 | | | 2.20 | | | |
| Maximum C.G. Load Factor (Negative) | .675 | 95 | 80 | | | .79 | | | |
| Maximum Longitudinal Accel. (Positive) | .190 | 1030 | 980 | -1285 | 65 | | .12 | | |
| Maximum Longitudinal Accel. (Negative) | .080 | -35 | 450 | -130 | 1570 | | -.65 | | |
| Maximum Lateral Accel. (Pos., to Right) | .200 | 1010 | 960 | -535 | 220 | | | +.86 | |
| Maximum Lateral Accel. (Neg., to Left) | .167 | 1290 | 1245 | 780 | -315 | | | -.26 | |

| | | | | | |
|--------------------|--|--|--|-----------------------|---------|
| REPORT NO. FT245-1 | | FAIRCHILD Aircraft and Missiles Div. | | PAGES | PAGE 83 |
| MODEL M-245B | | OF FAIRCHILD ENGINE & AIRPLANE CORPORATION | | APPROVED BY | |
| PREPARED BY | | CHECKED BY | | DATE January 22, 1960 | |
| SUBJECT:- | | APPENDIX I
LANDING GEAR TEST DATA, M-245B | | REVISED | |

TABLE V - continued
 L-19A HIGH FLOTATION TIRE LANDING LOADS
 S/N 51-7441
 Data Request No. L-19-6
 Sinking Speed 3.0 fps
 L-19A Flight No. 19-16
 Tire Pressure - L. 8.8 psi
 R. 8.0 psi

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs)
Right Left | Drag Strut
Axial Load
(lbs)
Right Left | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---|---------------|---|---|------------------------------|------------------------|-----------------------|----------------|
| Oscillograph Record No. 25176 | 0 | | | | | | 50.3 |
| First Gear Contact (Left Gear) | | | | | | | |
| Initial Left Drag Strut Axial Load | .093 | 840 1425 | 365 1495 | | -1.09 | | |
| Left Drag Strut Axial Load, Springback | .115 | 1105 1465 | 1285 -2045 | | .49 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .140 | 1310 1385 | 900 400 | | -.31 | | |
| Maximum Left Gear Vertical Load | .110 | 1045 1490 | 980 -1830 | 1.98 | | | |
| Left Gear Vertical Load Rebound | .520 | 55 20 | -30 0 | .93 | | | |
| Initial Right Drag Strut Axial Load | .125 | 1235 1425 | 1640 -830 | | -1.01 | | |
| Right Drag Strut Axial Load, Springback | .159 | 1270 1260 | -1980 -45 | | .76 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .179 | 1120 1035 | 710 -315 | | -.45 | | |
| Maximum Right Gear Vertical Load | .133 | 1365 1385 | 1475 110 | 2.02 | | | |
| Right Gear Vertical Load Rebound | .389 | -20 85 | -90 10 | .76 | | | |
| Maximum C.G. Load Factor (Positive) | .135 | 1325 1405 | | 2.05 | | | |
| Maximum C.G. Load Factor (Negative) | .410 | 75 105 | | .74 | | | |
| Maximum Longitudinal Accel. (Positive) | .155 | 1270 1280 | -1880 -20 | | .93 | | |
| Maximum Longitudinal Accel. (Negative) | .093 | 840 1425 | 365 1495 | | -1.09 | | |
| Maximum Lateral Accel. (Pos., to Right) | .159 | 1270 1260 | -1980 -45 | | | .40 | |
| Maximum Lateral Accel. (Neg., to Left) | .090 | 785 1405 | 605 1435 | | | -.30 | |

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|--------------------|--------|--|------------|-------------|-----------------------|----|
| MODEL | M-245B | PREPARED BY | CHECKED BY | APPROVED BY | | |
| SUBJECT:- | | APPENDIX I
LANDING GEAR TEST DATA, M-245B | | | DATE January 22, 1960 | |
| | | | | | REVISED | |

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|------------------------|-----------------------|----------------|
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. 25177 | 0 | | | | | | | | 44.7 |
| First Gear Contact (Left Gear) | | | | | | | | | |
| Initial Left Drag Strut Axial Load | .075 | 1100 | 1445 | 680 | 1585 | | -1.13 | | |
| Left Drag Strut Axial Load, Springback | .099 | 1325 | 1630 | 1770 | -2370 | | .41 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .125 | 1310 | 1280 | -1660 | 690 | | .93 | | |
| Maximum Left Gear Vertical Load | .100 | 1365 | 1630 | 1940 | -2240 | 2.11 | | | |
| Left Gear Vertical Load Rebound | .390 | 410 | 40 | 70 | -10 | .80 | | | |
| Initial Right Drag Strut Axial Load | .100 | 1365 | 1630 | 1940 | -2240 | | - .27 | | |
| Right Drag Strut Axial Load, Springback | .129 | 1290 | 1280 | -1790 | 690 | | .62 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .154 | 1085 | 1260 | 1205 | -765 | | .10 | | |
| Maximum Right Gear Vertical Load | .115 | 1515 | 1425 | 365 | -10 | 1.83 | | | |
| Right Gear Vertical Load Retound | .680 | 20 | 85 | -10 | -65 | .85 | | | |
| Maximum C.G. Load Factor (Positive) | .090 | 1235 | 1590 | | | 2.35 | | | |
| Maximum C.G. Load Factor (Negative) | .510 | 185 | 85 | | | .32 | | | |
| Maximum Longitudinal Accel. (Positive) | .125 | 1310 | 1280 | -1660 | 690 | | .93 | | |
| Maximum Longitudinal Accel. (Negative) | .070 | 1065 | 1425 | 730 | 1530 | | -1.42 | | |
| Maximum Lateral Accel. (Pos., to Right) | .136 | 1100 | 1260 | -435 | 120 | | | .32 | |
| Maximum Lateral Accel. (Neg., to Left) | .115 | 1515 | 1425 | 365 | -10 | | | - .51 | |

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|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|------------------------|-----------------------|----------------|---|------|----|
| MODEL <u>M-245B</u> | | PREPARED BY | | | | CHECKED BY | | | | APPROVED BY | | |
| SUBJECT:-- <u>APPENDIX I</u>
<u>LANDING GEAR TEST DATA, M-245B</u> | | | | | | | | | | DATE <u>January 22, 1960</u>
REVISED | | |
| <div style="display: flex; justify-content: space-between;"> <div> <p>L-19A Flight No. L-19-14</p> <p>Tire Pressure - L. 8.8 psi</p> <p>R. 8.5 psi</p> </div> <div> <p>S/N 51-7441</p> <p>Sinking Speed 3.5 fps</p> </div> <div> <p>Data Request No. L-19-6</p> </div> </div> | | | | | | | | | | | | |
| <p style="text-align: center;">TABLE V - continued</p> <p style="text-align: center;">L-19A HIGH FLUTATION TIRE LANDING LOADS</p> | | | | | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) | | | |
| | | Right | Left | Right | Left | | | | | | | |
| Oscillograph Record No. <u>24968</u> | 0 | | | | | | | | 47.6* | | | |
| First Gear Contact (Left Main) | | | | | | | | | | | | |
| Initial Left Drag Strut Axial Load | .087 | 1285 | 2100 | 670 | 1520 | | -.43 | | | | | |
| Left Drag Strut Axial Load, Springback | .116 | 1515 | 1925 | 1440 | -2260 | | -.29 | | | | | |
| Left Drag Strut Axial Load, 2nd Cycle | .143 | 1435 | 1420 | -990 | 740 | | -.41 | | | | | |
| Maximum Left Gear Vertical Load | .086 | 1295 | 2110 | 660 | 1500 | 2.40 | | | | | | |
| Left Gear Vertical Load Rebound | .444 | 110 | - 65 | 30 | - 20 | .76 | | | | | | |
| Initial Right Drag Strut Axial Load | .114 | 1500 | 1915 | 1740 | -2110 | | -.20 | | | | | |
| Right Drag Strut Axial Load, Springback | .135 | 1490 | 1535 | -1730 | 140 | | -.46 | | | | | |
| Right Drag Strut Axial Load, 2nd Cycle | .165 | 1225 | 1320 | 650 | -240 | | .05 | | | | | |
| Maximum Right Gear Vertical Load | .125 | 1550 | 1790 | -220 | -1320 | 2.84 | | | | | | |
| Right Gear Vertical Load Rebound | .386 | - 40 | 155 | - 30 | 40 | .81 | | | | | | |
| Minimum C.G. Load Factor (Positive) | .137 | 1490 | 1540 | | | 2.87 | | | | | | |
| Maximum C.G. Load Factor (Negative) | .460 | 40 | 85 | | | .74 | | | | | | |
| Maximum Longitudinal Accel. (Positive) | .154 | 1280 | 1405 | 130 | 330 | | .15 | | | | | |
| Maximum Longitudinal Accel. (Negative) | .075 | 1145 | 1720 | 690 | 1300 | | -.60 | | | | | |
| Maximum Lateral Accel. (Pos. to Right) | .140 | 1460 | 1435 | -1400 | 650 | | | .35 | | | | |
| Maximum Lateral Accel. (Neg. to Left) | .120 | 1530 | 1890 | 1090 | -1890 | | | -.49 | | | | |

* Ground speed measured at instant of tail wheel touchdown.

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|---|----------------|---------------------------|------|-----------------------------------|------------|------------------------------|------------------------|-----------------------|----------------|------------------------------|---------|
| MODEL
<u>M-245B</u> | | PREPARED BY | | | CHECKED BY | | | APPROVED BY | | | |
| SUBJECT: <u>APPENDIX I
LANDING GEAR TEST DATA, M-245B</u> | | | | | | | | | | DATE <u>January 22, 1960</u> | |
| | | | | | | | | | | REVISED | |
| <p style="text-align: center;"> TABLE V - continued
 L-19A HIGH FLOTATION TIRE LANDING LOADS
 S/N 51-7441
 Sinking Speed 4.4 fps
 Data Request No. L-19-6 </p> | | | | | | | | | | | |
| <p style="text-align: center;"> L-19A Flight No. L-19-18
 Tire Pressure - L. 8.9 psi
 R. 8.0 psi </p> | | | | | | | | | | | |
| Item
(Event) | Time
(Sec.) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) | | |
| | | Right | Left | Right | Left | | | | | | |
| Oscillograph Record No. 25198 | | | | | | | | | | | |
| First Gear Contact (Right Main) | 0 | | | | | | | | 50.0 | | |
| Initial Left Drag Strut Axial Load | .129 | 1165 | 1445 | 245 | 1770 | | -.59 | | | | |
| Left Drag Strut Axial Load, Springback | .164 | 945 | 1180 | -100 | -1580 | | +.63 | | | | |
| Left Drag Strut Axial Load, 2nd Cycle | .197 | 870 | 970 | -180 | 735 | | -.08 | | | | |
| Maximum Left Gear Vertical Load | .135 | 1260 | 1755 | 30 | 1685 | 2.45 | | | | | |
| Left Gear Vertical Load Rebound | .400 | 130 | -85 | -40 | -30 | .87 | | | | | |
| Initial Right Drag Strut Axial Load | .077 | 1500 | 145 | 1770 | 415 | | -1.17 | | | | |
| Right Drag Strut Axial Load, Springback | .103 | 1350 | 1000 | -1910 | 1160 | | +.12 | | | | |
| Right Drag Strut Axial Load, 2nd Cycle | .129 | 1165 | 1445 | 245 | 1770 | | -.59 | | | | |
| Maximum Right Gear Vertical Load | .092 | 1760 | 890 | -180 | 885 | 2.41 | | | | | |
| Right Gear Vertical Load Rebound | .320 | -35 | 330 | 0 | -105 | 1.15 | | | | | |
| Maximum C.G. Load Factor (Positive) | .135 | 1260 | 1755 | 30 | 1685 | 2.45 | | | | | |
| Maximum C.G. Load Factor (Negative) | .440 | 0 | 145 | -20 | 10 | .78 | | | | | |
| Maximum Longitudinal Accel. (Positive) | .160 | 905 | 1155 | -70 | -1505 | | +.77 | | | | |
| Maximum Longitudinal Accel. (Negative) | .120 | 1110 | 1280 | -140 | 1470 | | -.75 | | | | |
| Maximum Lateral Accel. (Pos., to Right) | .105 | 1315 | 1055 | -1820 | 1270 | | | +.57 | | | |
| Maximum Lateral Accel. (Neg., to Left) | .345 | 55 | 185 | -70 | -235 | | | -.35 | | | |

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|---|---------------|---------------------------|------|-----------------------------------|------------|------------------------------|------------------------|-----------------------|----------------|---|------|----|
| MODEL | | PREPARED BY | | | CHECKED BY | | | APPROVED BY | | | | |
| M-245B | | | | | | | | | | | | |
| SUBJECT: <u>APPENDIX I</u>
<u>LANDING GEAR TEST DATA, M-245B</u> | | | | | | | | | | DATE <u>January 22, 1960</u>
REVISED _____ | | |
| <p style="text-align: center;">TABLE V - continued</p> <p style="text-align: center;"><u>L-19A HIGH FLOTATION TIRE LANDING LOADS</u></p> <p style="text-align: center;">S/N <u>51-7441</u> Data Request No. <u>L-19-6</u></p> <p style="text-align: center;">L-19A Flight No. <u>L-19-18</u> Sinking Speed <u>4.8</u> fps</p> <p style="text-align: center;">Tire Pressure - <u>L. 9.2</u> psi R. <u>8.1</u> psi</p> | | | | | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) | | | |
| | | Right | Left | Right | Left | | | | | | | |
| Oscillograph Record No. <u>25197</u> | | | | | | | | | | | | |
| First Gear Contact (Right Main) | 0 | | | | | | | | | 49.0 | | |
| Initial Left Drag Strut Axial Load | .103 | 1740 | 1695 | -2075 | 2475 | | -.02 | | | | | |
| Left Drag Strut Axial Load, Springback | .129 | 1315 | 1675 | 1100 | 2290 | | -.16 | | | | | |
| Left Drag Strut Axial Load, 2nd Cycle | .160 | 1260 | 1405 | -475 | 950 | | -.18 | | | | | |
| Maximum Left Gear Vertical Load | .113 | 1590 | 1860 | -285 | 1120 | 2.69 | | | | | | |
| Left Gear Vertical Load Rebound | .370 | 55 | 20 | 20 | -30 | 1.0 | | | | | | |
| Initial Right Drag Strut Axial Load | .075 | 1500 | 1220 | 1810 | 1225 | | -1.03 | | | | | |
| Right Drag Strut Axial Load, Springback | .100 | 1760 | 1590 | -2145 | 2145 | | -.10 | | | | | |
| Right Drag Strut Axial Load, 2nd Cycle | .130 | 1295 | 1630 | 1235 | 1920 | | -.24 | | | | | |
| Maximum Right Gear Vertical Load | .090 | 1795 | 1165 | -365 | 1375 | 2.47 | | | | | | |
| Right Gear Vertical Load Rebound | .310 | 35 | 85 | 100 | -105 | 1.04 | | | | | | |
| Maximum C.G. Load Factor (Positive) | .115 | 1165 | 1840 | | | 2.72 | | | | | | |
| Maximum C.G. Load Factor (Negative) | .345 | 75 | 60 | | | .96 | | | | | | |
| Maximum Longitudinal Accel. (Positive) | .115 | 1165 | 1840 | -160 | 500 | | +.10 | | | | | |
| Maximum Longitudinal Accel. (Negative) | .065 | 1240 | 870 | 1375 | 1440 | | -1.23 | | | | | |
| Maximum Lateral Accel. (Pos., to Right) | .172 | 1090 | 1200 | -180 | 75 | | | +.60 | | | | |
| Maximum Lateral Accel. (Neg., to Left) | .187 | 1075 | 910 | 60 | -320 | | | -.50 | | | | |

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|--|---------------|-------------------------------------|------|-----------------------------------|-------|--|------------------------|-----------------------|----------------|
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| <p>APPENDIX I</p> <p>LANDING GEAR TEST DATA, M-245B</p> | | | | | | <p>DATE <u>January 22, 1960</u></p> <p>REVISED</p> | | | |
| <p>TABLE V - continued</p> <p><u>L-19A HIGH FLOATION TIRE LANDING LOADS</u></p> <p>S/N <u>51-7441</u></p> <p>Sinking Speed <u>6.4 fps</u></p> <p>Data Request No. <u>L-19-6</u></p> <p>L-19A Flight No. <u>L-19-18</u></p> <p>Tire Pressure - L. <u>9.3 psi</u></p> <p>R. <u>8.1 psi</u></p> | | | | | | | | | |
| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Speed
(MPH) |
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. <u>25196</u> | | | | | | | | | |
| First Gear Contact (Right Main) | 0 | | | | | | | | 51.6 |
| Initial Left Drag Strut Axial Load | .067 | 2500 | 1130 | 1910 | 1590 | | -1.74 | | |
| Left Drag Strut Axial Load, Springback | .134 | 1760 | 2005 | 595 | -2120 | | +1.09 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .167 | 1635 | 1590 | -405 | 500 | | + .10 | | |
| Maximum Left Gear Vertical Load | .115 | 1850 | 2230 | 365 | 1175 | 2.43 | | | |
| Left Gear Vertical Load Rebound | .400 | 95 | 40 | -110 | -150 | .93 | | | |
| Initial Right Drag Strut Axial Load | .067 | 2500 | 1180 | 1910 | 1590 | | -1.74 | | |
| Right Drag Strut Axial Load, Springback | .095 | 2185 | 1920 | -2395 | 1430 | | + .44 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .126 | 1760 | 2085 | 840 | -1740 | | +1.09 | | |
| Maximum Right Gear Vertical Load | .067 | 2500 | 1180 | 1910 | 1590 | 2.58 | | | |
| Right Gear Vertical Load Rebound | .345 | 55 | 105 | - 80 | -150 | 1.11 | | | |
| Maximum C.G. Load Factor (Positive) | .089 | 2240 | 1695 | | | 3.22 | | | |
| Maximum C. G. Load Factor (Negative) | .320 | 75 | 125 | | | .80 | | | |
| Maximum Longitudinal Accel. (Positive) | .130 | 1760 | 2045 | 790 | -2036 | | 1.11 | | |
| Maximum Longitudinal Accel. (Negative) | .067 | 2500 | 1180 | 1910 | 1590 | | -1.74 | | |
| Maximum Lateral Accel. (Pos., to Right) | .069 | 2480 | 1200 | 1630 | 1565 | | | + .65 | |
| Maximum Lateral Accel. (Neg., to Left) | .203 | 1315 | 1075 | 150 | -450 | | | - .46 | |

MODEL M-245B

PREPARED BY

CHECKED BY

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APPENDIX I

SUBJECT:- LANDING GEAR TEST DATA, M-245B

DATE January 22, 1960

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TABLE VI - continued

L-19A HIGH FLOTATION TIRE LANDING LOADS

L-19A Flight No. L-19-28

S/N 51-7441

April 1, 1960

Tire Pressure - L. 8.2 psi**

Sinking Speed 8.85 fps

Data Request No. L-19-6B

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long. Lat.
Acc.
(g's) (f's) | Speed
(MPH) |
|---|---------------|---------------------------|------|-----------------------------------|--------|------------------------------|-----------------------------------|----------------|
| | | Right | Left | Right | Left | | | |
| Oscillograph Record No. 25908 | | | | | | | | |
| First Gear Contact (Left Main Gear) | 0 | | | | | | | |
| Initial Left Drag Strut Axial Load | .029 | 50 | 1530 | -175 | 2325 | | | |
| Left Drag Strut Axial Load, Springback | .073 | 1330 | 3870 | 2370 | -2585* | | | |
| Left Drag Strut Axial Load, 2nd Cycle | .120 | 2540 | 2820 | -1250 | 1000 | | | |
| Maximum Left Gear Vertical Load | .073 | 1330 | 3870 | 2370 | -2585* | 3.13 | | |
| Left Gear Vertical Load Rebound | .590 | 15 | -75 | 90 | 115 | .58 | | |
| Initial Right Drag Strut Axial Load | .075 | 1350 | 3715 | 2410 | -2585* | | | |
| Right Drag Strut Axial Load, Springback | .115 | 2855 | 2725 | -1680* | 700 | | | |
| Right Drag Strut Axial Load, 2nd Cycle | .139 | 2250 | 3090 | 1145 | 0 | | | |
| Maximum Right Gear Vertical Load | .110 | 3110 | 2860 | -1680* | 600 | 4.08 | | |
| Right Gear Vertical Load Rebound | .425 | -35 | 55 | 75 | 155 | .60 | | |
| Maximum C.G. Load Factor (Positive) | .110 | 3110 | 2860 | | | 4.08 | | |
| Maximum C.G. Load Factor (Negative) | .650 | -17 | 0 | | | .58 | | |
| Maximum Longitudinal Accel. (Positive) | .110 | 3110 | 2860 | -1680* | 600 | | +1.24 | |
| Maximum Longitudinal Accel. (Negative) | .029 | 50 | 1580 | -175 | 2325 | | -.88 | |
| Maximum Lateral Accel. (Pos. to Right) | .200 | 1850 | 1470 | -165 | 185 | | | 1.10* |
| Maximum Lateral Accel. (Neg. to Left) | .225 | 1175 | 1485 | -35 | -380 | | | -1.50 |

* Traces off oscillograph.

** Right Tire Pressure Unavailable.

*** Forward Velocity not recorded.

| | | | | | |
|--|--|-------------------------------------|------------|-----------------------|---------|
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| SUBJECT:- APPENDIX I
LANDING GEAR TEST DATA, M-245B | | | | DATE January 22, 1960 | |
| | | | | REVISED | |

TABLE VI - continued
L-19A HIGH FLOTATION TIRE LANDING LOADS

L-19A Flight No. L-19-20
Tire Pressure - L. 2.5 psi**
S/N 51-7441
Sinking Speed 10.25 fps
April 4, 1960
Data Request No. L-19-63

| Item
(Event) | Time
(Sec) | Vertical
Load
(lbs) | | Drag Strut
Axial Load
(lbs) | | C.G. Load
Factor
(g's) | Long. Lat.
Acc.
(g's) | Speed
(ft/sec) |
|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|-----------------------------|-------------------|
| | | Right | Left | Right | Left | | | |
| Oscillograph Record No. 25927 | 0 | | | | | | | * |
| First Gear Contact (Left Main Gear) | | | | | | | | |
| Initial Left Drag Strut Axial Load | .031 | 790 | 1590 | 800 | 2660 | | -1.47 | |
| Left Drag Strut Axial Load, Springback | .081 | 2030 | 3720 | -290 | -2970 | | 1.51 | |
| Left Drag Strut Axial Load, 2nd Cycle | .116 | 250 | 3450 | 660 | 780 | | -0.35 | |
| Maximum Left Gear Vertical Load | .087 | 3000 | 3920 | -1750 | -1620 | +3.90 | | |
| Left Gear Vertical Load Rebound | .657 | 100 | 30 | 80 | 110 | + .62 | | |
| Initial Right Drag Strut Axial Load | .055 | 1900 | 2910 | 1950 | 1880 | | -1.60 | |
| Right Drag Strut Axial Load, Springback | .092 | 2970 | 3800 | -2560 | -240 | | +1.43 | |
| Right Drag Strut Axial Load, 2nd Cycle | .124 | 2410 | 3340 | 770 | 690 | | -0.15 | |
| Maximum Right Gear Vertical Load | .087 | 3000 | 3920 | -1750 | -1620 | +3.90 | | |
| Right Gear Vertical Load Rebound | .350 | -20 | 340 | 0 | -170 | + .62 | | |
| Maximum C.G. Load Factor (Positive) | .060 | 2100 | 3110 | | | 4.15 | | |
| Maximum C.G. Load Factor (Negative) | .002 | 0 | 0 | | | .96 | | |
| Maximum Longitudinal Accel. (Positive) | .087 | 3000 | 3920 | -1750 | -1620 | | +1.70 | |
| Maximum Longitudinal Accel. (Negative) | .042 | 1410 | 2120 | 1420 | 2610 | | -1.84 | |
| Maximum Lateral Accel. (Pos. to Right) | .173 | 1900 | 1890 | -180 | 80 | | +1.61 | |
| Maximum Lateral Accel. (Neg. to Left) | .144 | 2290 | 3130 | -60 | 100 | | -1.09 | |

* Forward Velocity unavailable.
** Right Tire Pressure unavailable.

MODEL

M-245B

PREPARED BY

CHECKED BY

APPENDIX I

SUBJECT:- LANDING GEAR TEST DATA, M-245B

Data Request No. L-19-6

TABLE VI - continued

L-19A HIGH FLOTATION TIRE DROP TEST LOADS

S/N 51-7441

L-19A Drop Test

Tire Pressure - Right 8.5

Left 8.5

| Item
(Event) | Time
(Sec) | Vertical
Load
(Lbs) | | Drag Strut
Axial Load
(Lbs) | | C.G. Load
Factor
(g's) | Long.
Acc.
(g's) | Lat.
Acc.
(g's) | Sinking
Speed
(FPS) |
|---|---------------|---------------------------|------|-----------------------------------|-------|------------------------------|------------------------|-----------------------|---------------------------|
| | | Right | Left | Right | Left | | | | |
| Oscillograph Record No. 25138 | | | | | | | | | |
| First Gear Contact Simultaneous | | | | | | | | | |
| Initial Left Drag Strut Axial Load | .056 | 95 | 65 | 20 | -35 | | 1.57 | | |
| Left Drag Strut Axial Load, Springback | .215 | 2215 | 1820 | -755 | -1010 | | 2.33 | | |
| Left Drag Strut Axial Load, 2nd Cycle | .295 | 1485 | 1315 | -505 | -595 | | 2.10 | | |
| Maximum Left Gear Vertical Load | .215 | 2215 | 1820 | -755 | -1010 | 2.13 | | | |
| Left Gear Vertical Load Rebound | .610 | 500 | 615 | -205 | -295 | .51 | | | |
| Initial Right Drag Strut Axial Load | .056 | 95 | 65 | 20 | -35 | | 1.57 | | |
| Right Drag Strut Axial Load, Springback | .215 | 2215 | 1820 | -755 | -1010 | | 2.33 | | |
| Right Drag Strut Axial Load, 2nd Cycle | .295 | 1485 | 1315 | -505 | -595 | | 2.10 | | |
| Maximum Right Gear Vertical Load | .215 | 2215 | 1820 | -755 | -1010 | 2.13 | | | |
| Right Gear Vertical Load Rebound | .630 | 480 | 635 | -205 | -295 | .49 | | | |
| Maximum C.G. Load Factor (Positive) | .215 | 2215 | 1820 | | | 2.13 | | | |
| Maximum C.G. Load Factor (Negative) | .056 | 95 | 65 | | | -.54 | | | |
| Maximum Longitudinal Accel. (Positive) | .250 | 1925 | 1925 | -715 | -815 | | 2.48 | | |
| Maximum Longitudinal Accel. (Negative) | .060 | 95 | 85 | -95 | -100 | | 1.47 | | |
| Maximum Lateral Accel. (Pos. to Right) | .205 | 2025 | 1905 | -700 | -890 | | | 1.18 | |
| Maximum Lateral Accel. (Neg. to Left) | .220 | 210 | | | | | | | |

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